



water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA



DEVELOPMENT OF AN EUTROPHICATION MANAGEMENT STRATEGY FOR SOUTH AFRICA

(PSC Meeting)

Presented by:

JJ VAN WYK

Scientist Manager: Water Quality Planning (Central)

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the Department of Water and Sanitation
Private Bag X313
PRETORIA, 0001
Republic of South Africa

Tel: (012) 336 7500/ +27 12 336 7500

Fax: (012) 336 6731/ +27 12 336 6731

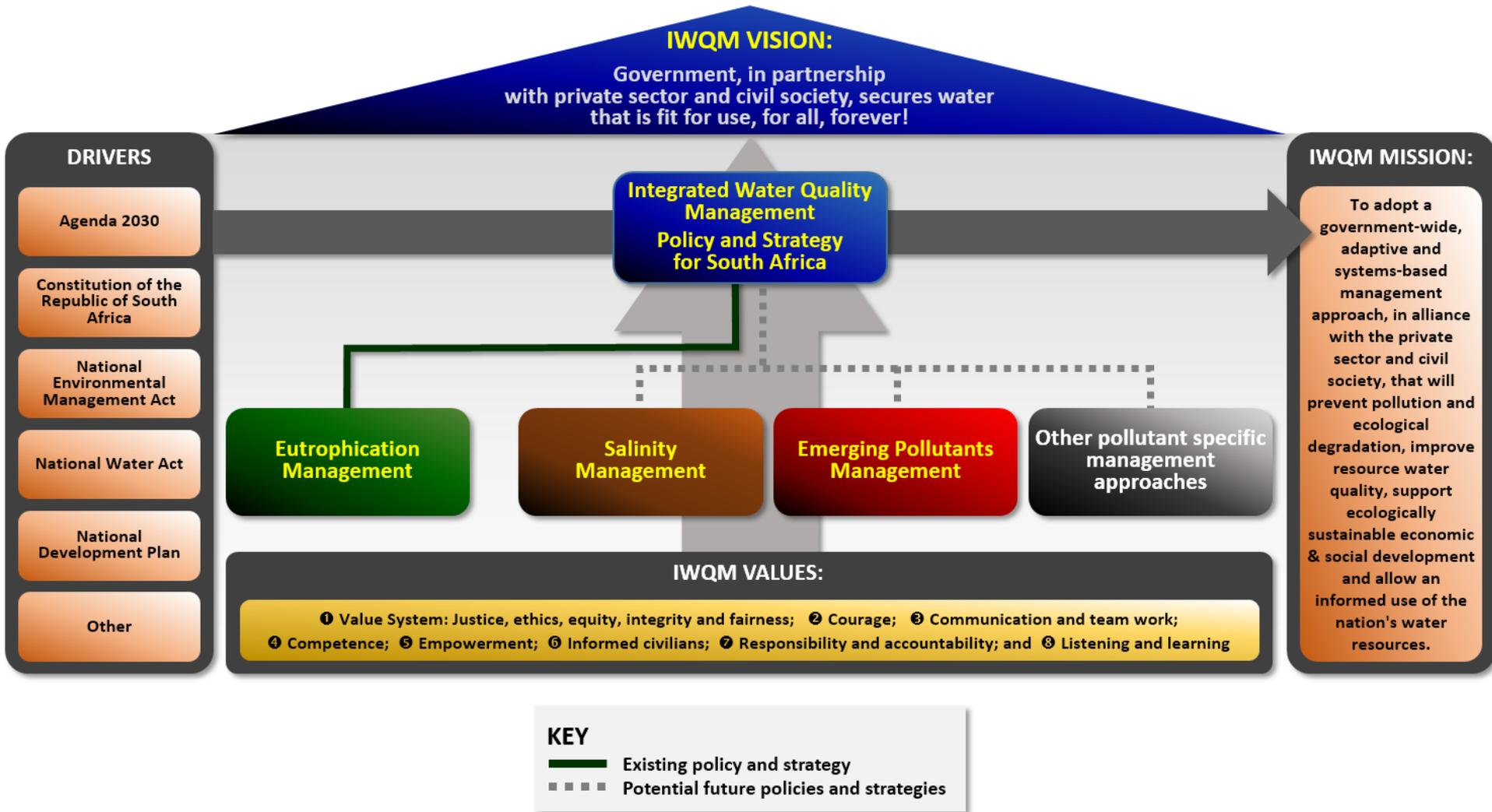
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IWQM POLICY AND STRATEGY FOR SOUTH AFRICA



EUTROPHICATION MANAGEMENT STRATEGY FOR SOUTH AFRICA

August 2021 Edition 01 (Version 12.2)

Project Report No. 4.1



WATER IS LIFE – SANITATION IS DIGNITY



water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

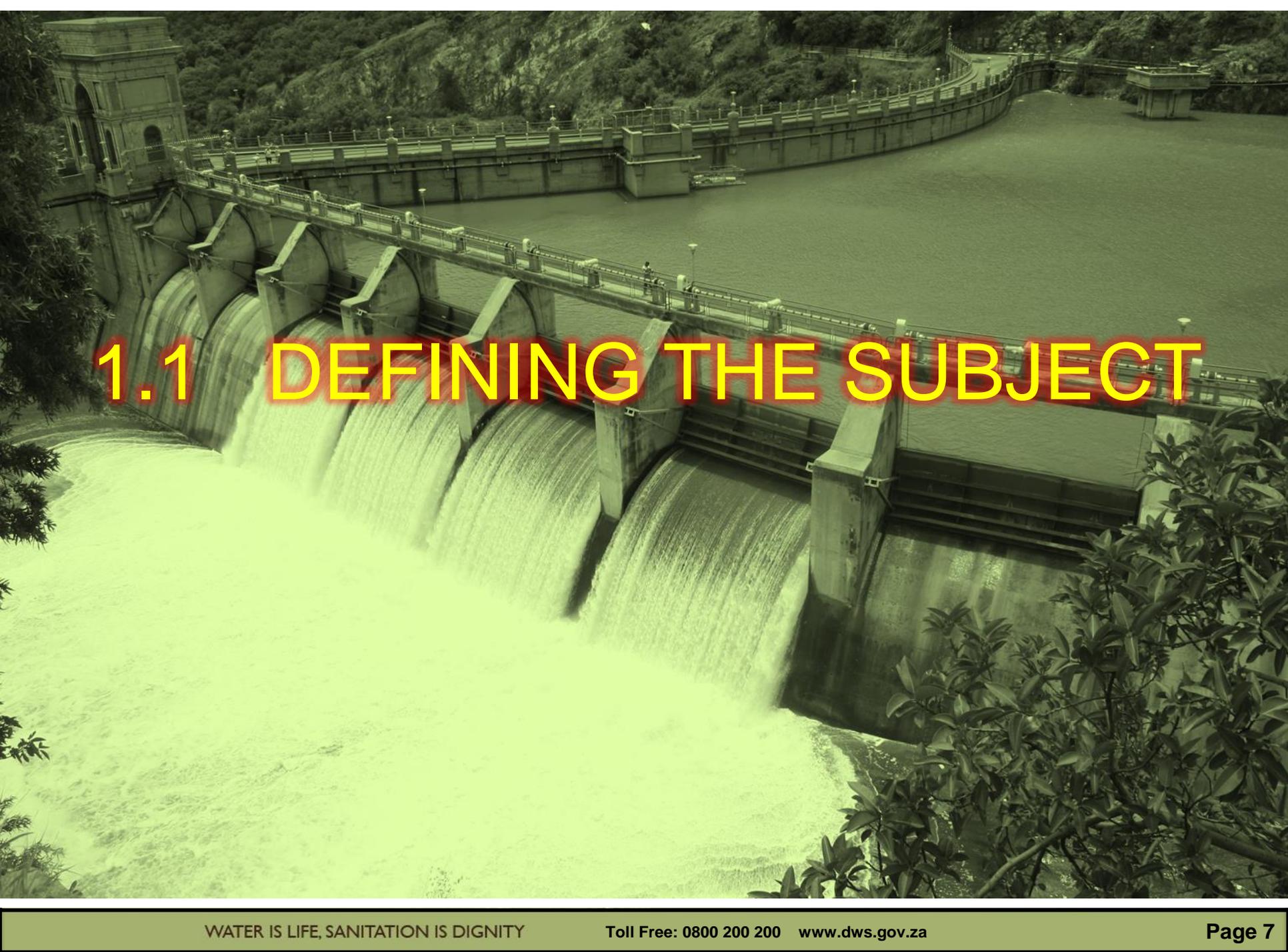


CONTENT



PART 1:

THE SOUTH AFRICAN CONTEXT



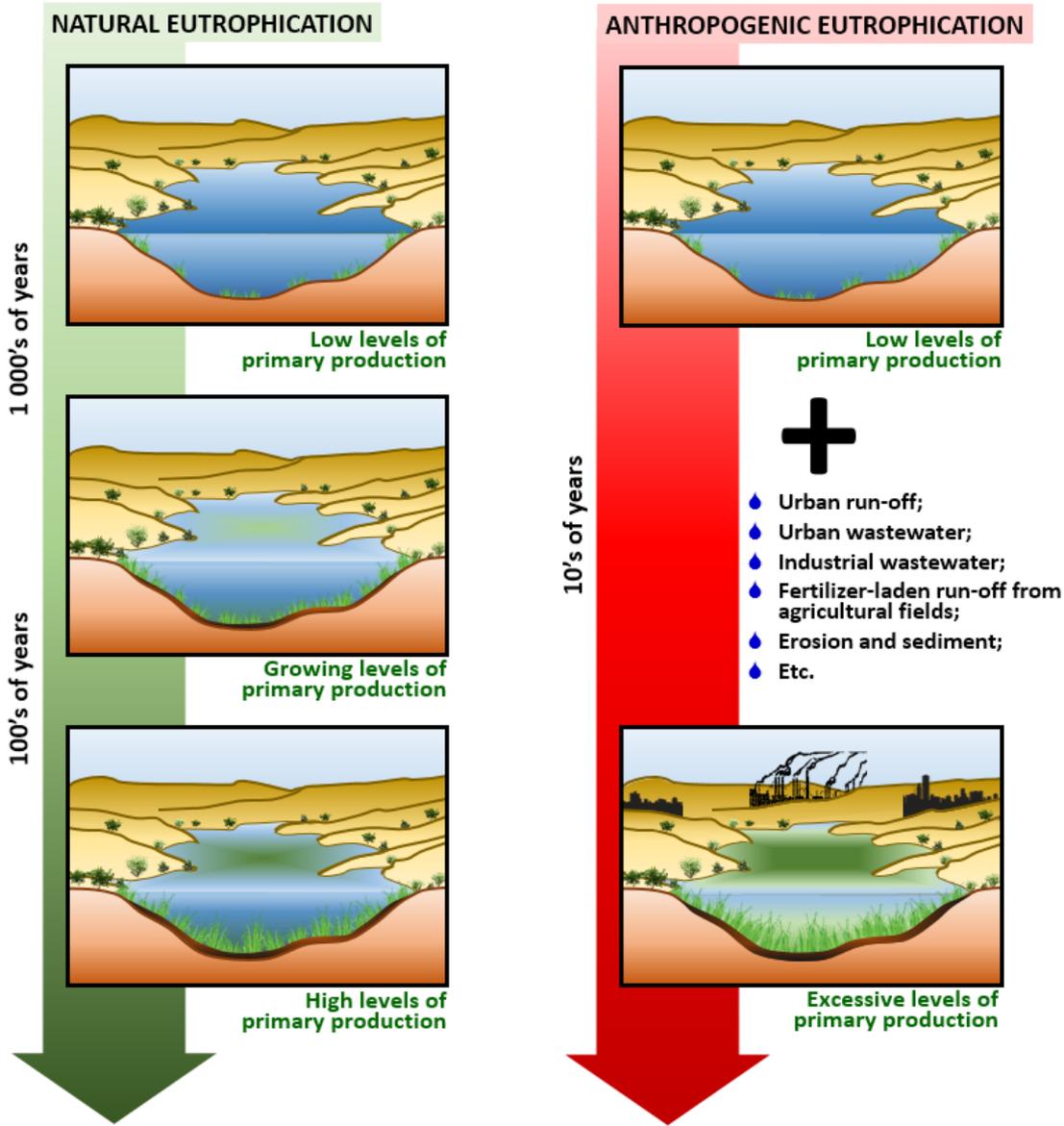
1.1 DEFINING THE SUBJECT

EUTROPHICATION IS THE PROCESS OF...

"... nutrient enrichment of waters, which results in the stimulation of an array of symptomatic changes, amongst which increased production of algae and aquatic macrophytes, deterioration of water quality, and others found to be undesirable and interfere with water users".

Organisation for Economic Cooperation and Development [OECD, 1982]

TWO TYPES OF EUTROPHICATION

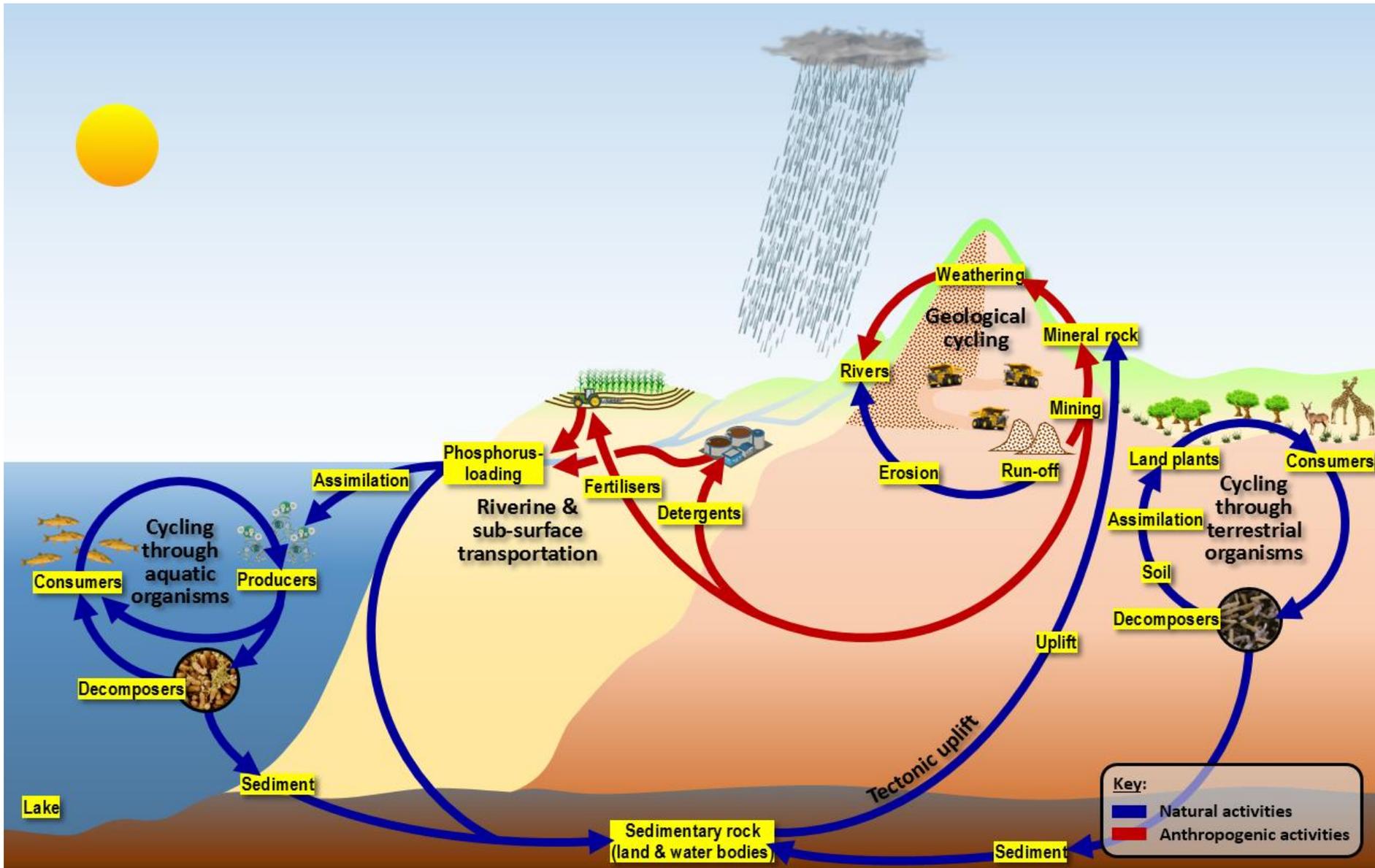


TYPES OF NUTRIENTS

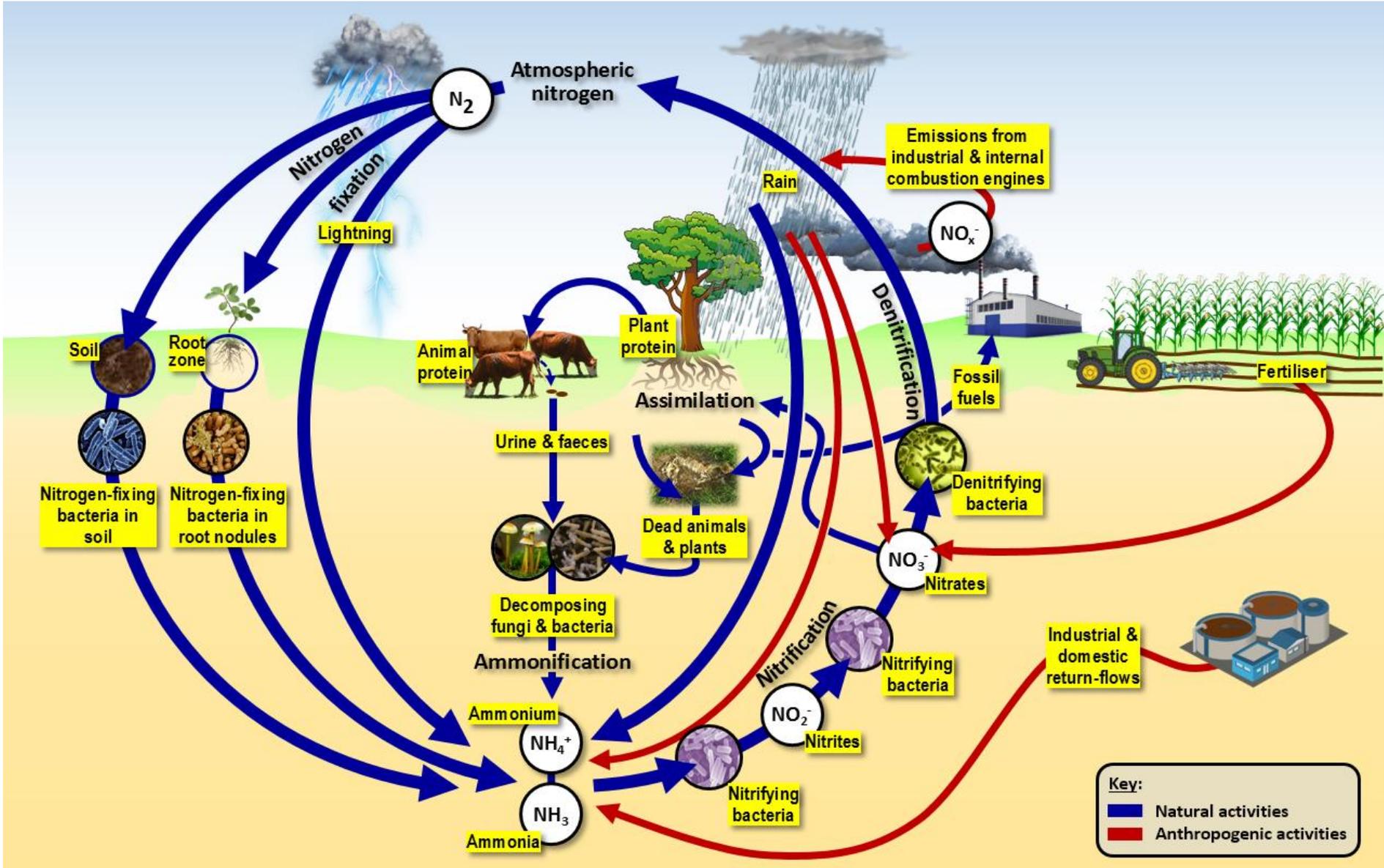
Macronutrients (or major elements), such as calcium (Ca), magnesium (Mg), potassium (K), carbon (C), hydrogen (H), oxygen (O), **nitrogen (N)**, **phosphorus (P)**, sulphur (S), iron (Fe), as well as silica (Si), used in cell frustules by diatoms and a few other algal species, being the most important of the macronutrients, are required in larger quantities; and

Micronutrients (or trace elements), such as copper (Cu), cobalt (Co), molybdenum (Mo), manganese (Mn), zinc (Zn), boron (Br), vanadium (Va), chlorine (Cl), **selenium (Se)** and vitamin complexes, being the most important of the micronutrients, are required in smaller quantities.

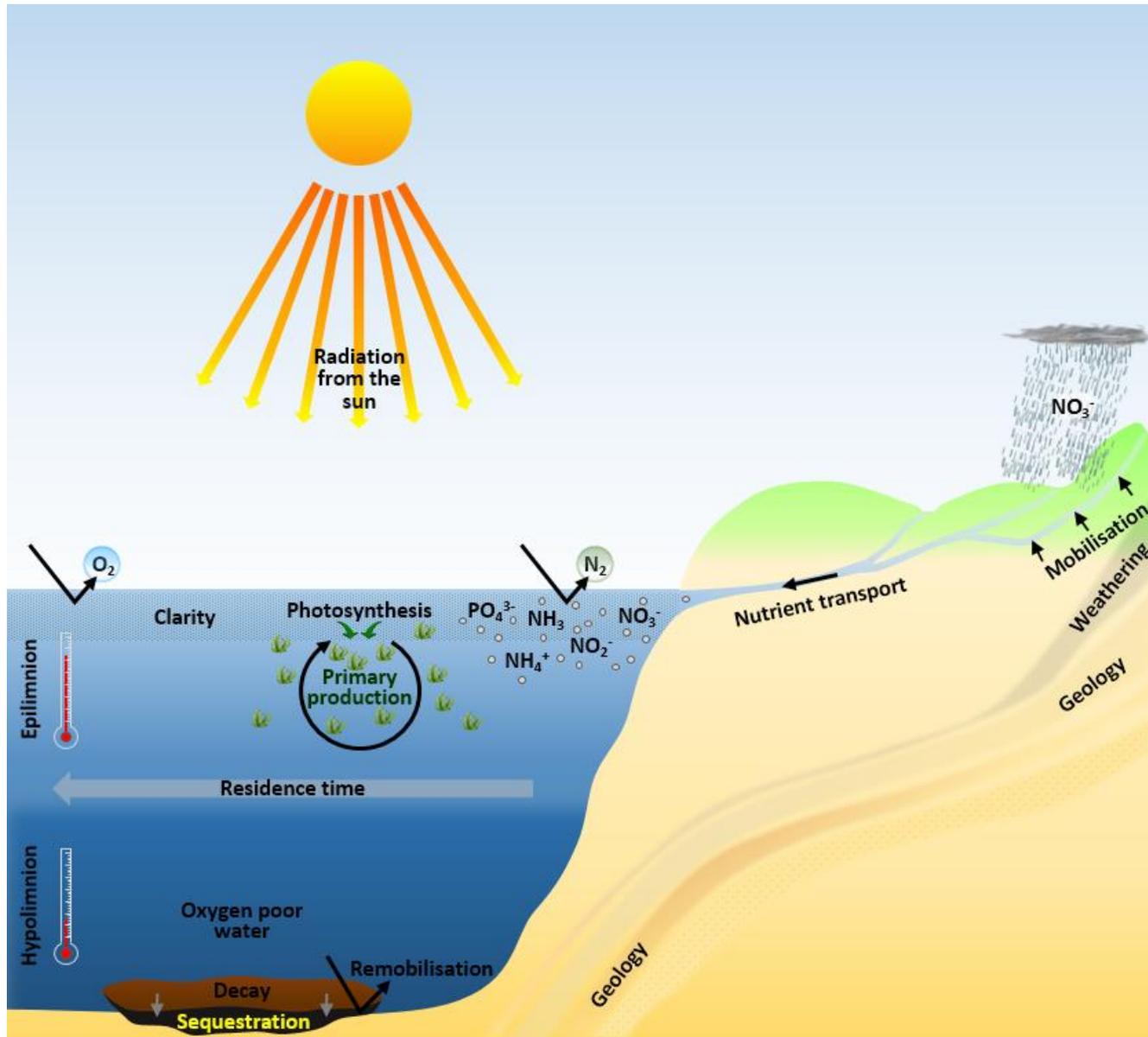
NUTRIENT CYCLING: PHOSPHORUS



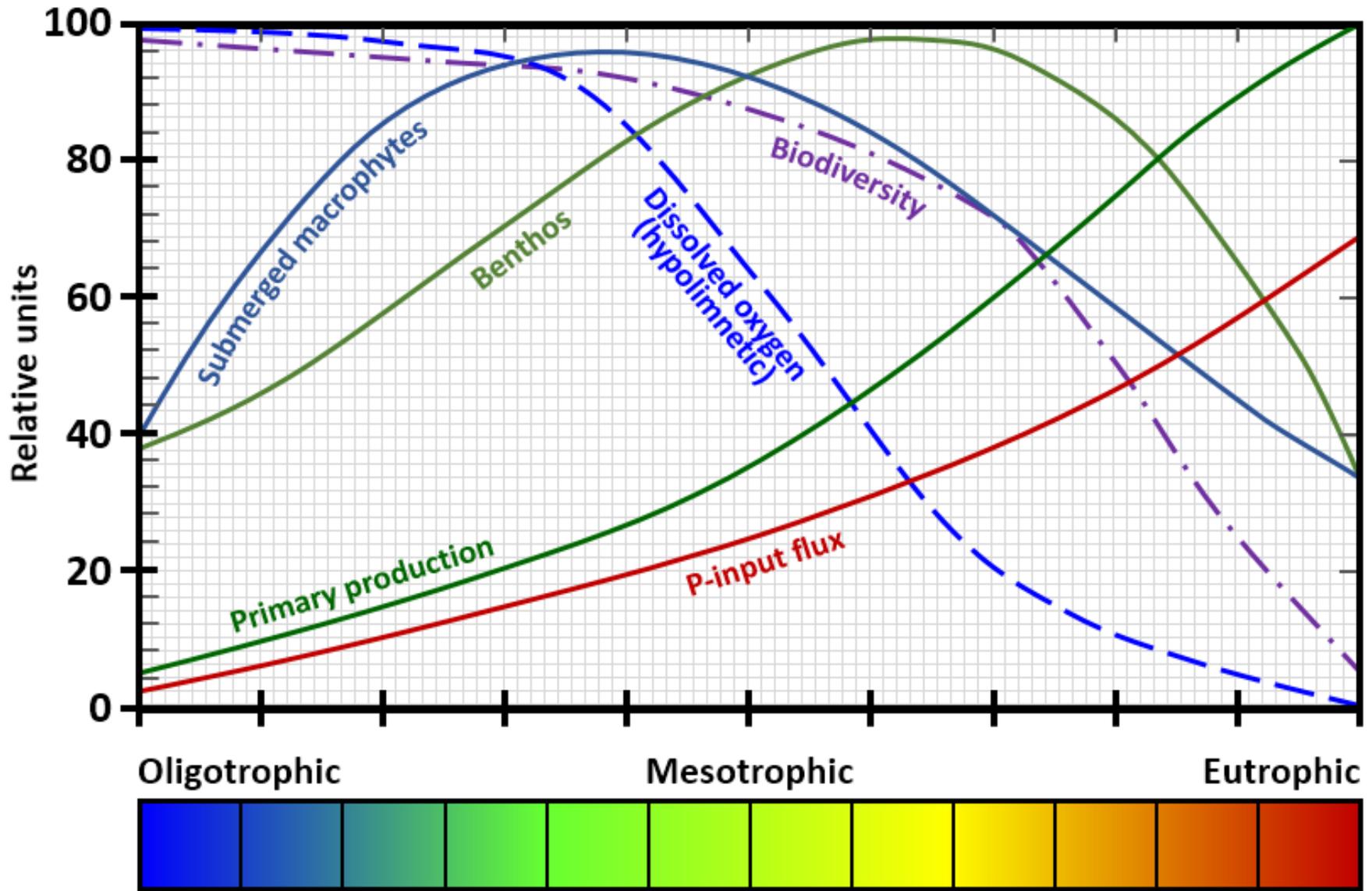
NUTRIENT CYCLING: NITROGEN



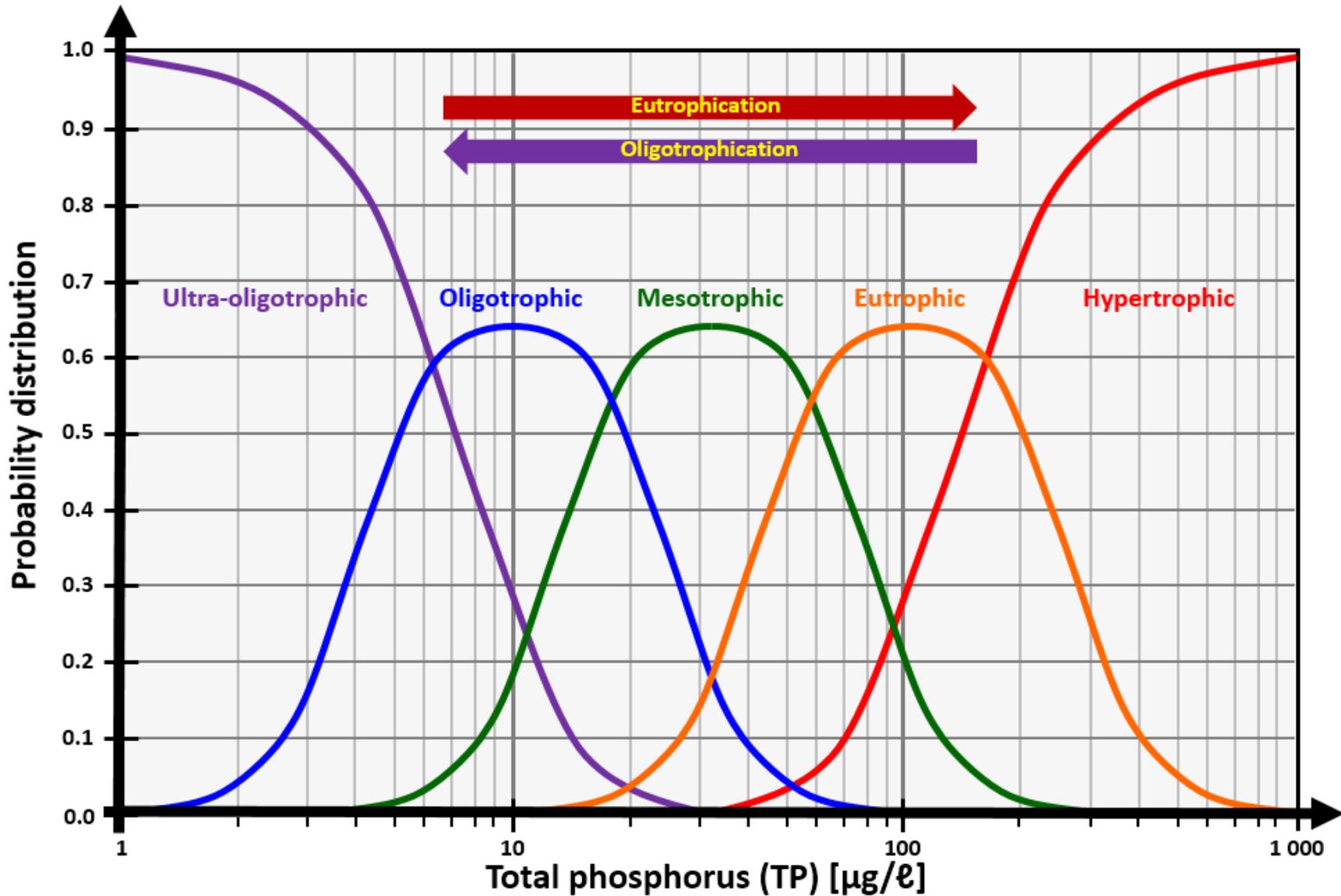
NATURAL FACTORS THAT AFFECT THE TROPHIC STATUS



CONCEPTUALISATION OF FRESHWATER EUTROPHICATION



THE PRIMARY PRODUCTION CONTINUUM

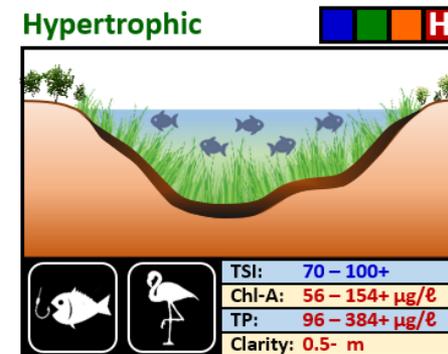
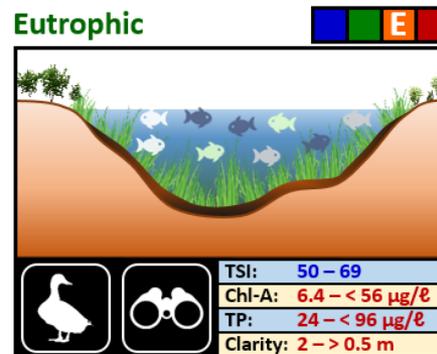
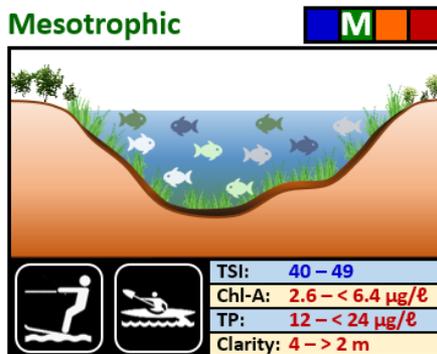
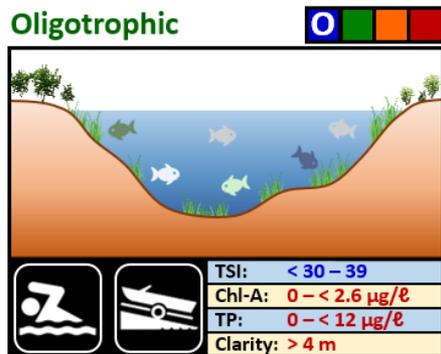


TROPHIC CRITERIA & THEIR RESPONSES TO INCREASED EUTROPHICATION

PHYSICAL	CHEMICAL	BIOLOGICAL
<p>Transparency (Secchi) ↓</p> <p>Suspended Solids ↑</p> <p>Electrical conductivity (EC) ↑</p>	<p>Nutrient concentrations ↑</p> <p>Chlorophyll-α ↑</p> <p>Dissolved solids ↑</p> <p>Hypolimnetic oxygen deficit ↑</p> <p>Epilimnetic oxygen supersaturation ↑</p>	<p>Algal bloom frequency ↑</p> <p>Algal species diversity ↓</p> <p>Phytoplankton biomass ↑</p> <p>Littoral vegetation ↑</p> <p>Zooplankton ↑</p> <p>Fish ↑</p> <p>Bottom fauna ↑</p> <p>Bottom fauna diversity ↓</p> <p>Primary production ↑</p>

TROPHIC STATE INDEX (TSI) AND ASSOCIATED PARAMETERS

TROPIC STATE INDEX (TSI)	SECCHI DISK [m]	TP [µg/ℓ]	CHL-A [µg/ℓ]	Trophic Class
0	64	0.75	0.04	"Oligotrophic"
10	32	1.5	0.12	
20	16	3	0.34	
30	8	6	0.94	
40	4	12	2.6	"Mesotrophic"
50	2	24	6.4	"Eutrophic"
60	1	48	20	
70	0.5	96	56	"Hypertrophic"
80	0.25	192	154	
90	0.12	384	427	
100	0.062	768	1183	

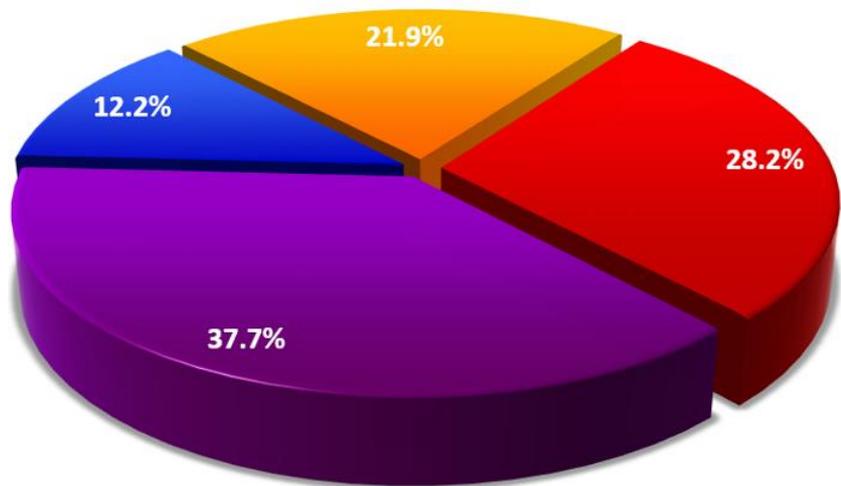
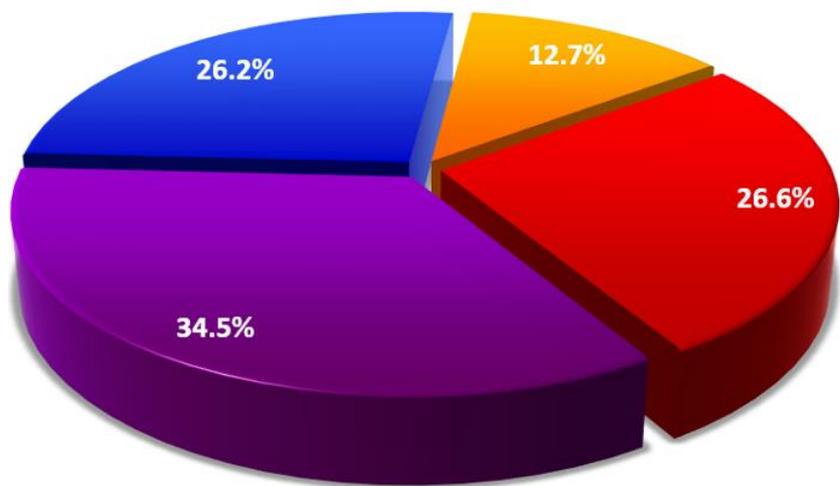


TROPIC STATUS OF 393 IMPORTANT SOUTH AFRICAN DAMS

1 October 2016 to 30 September 2017

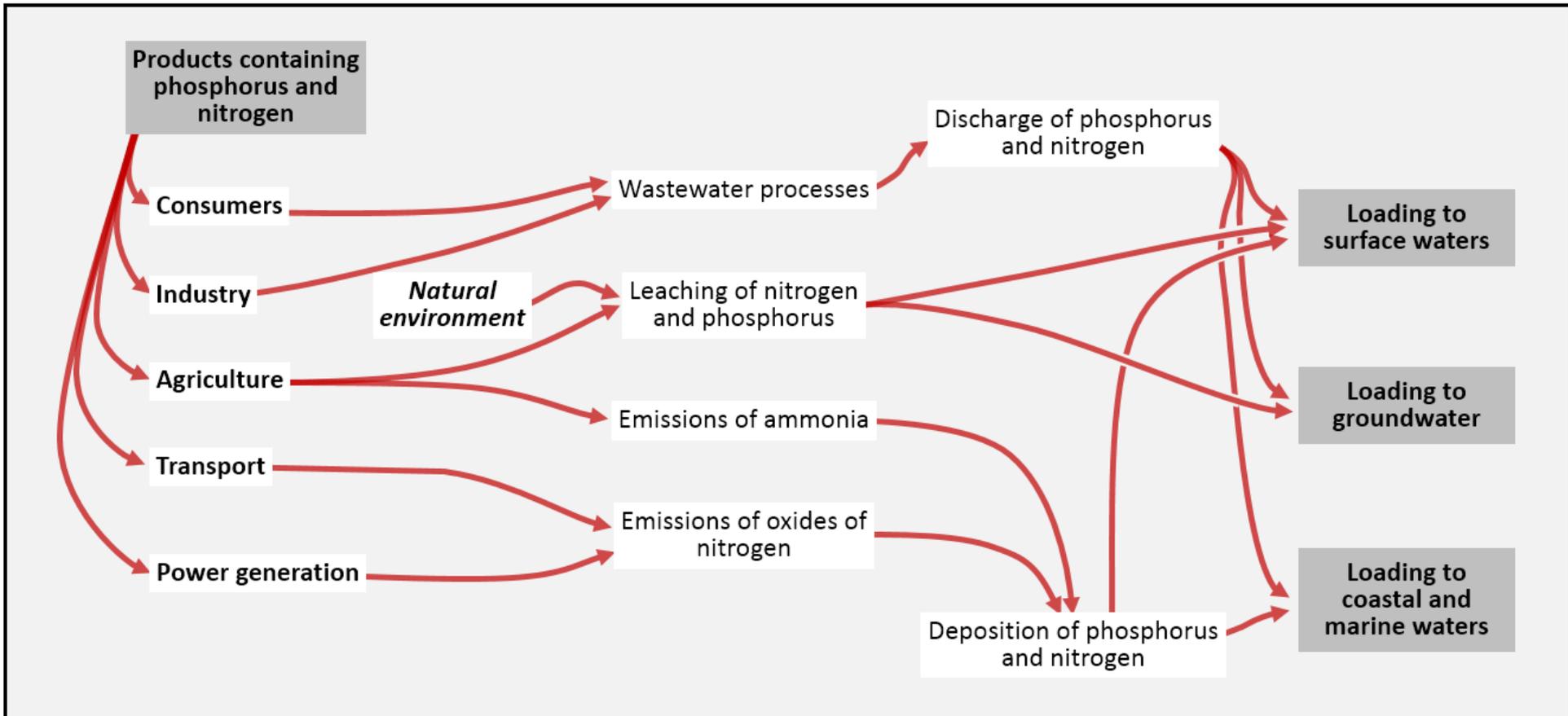


1 October 2019 to 30 September 2020

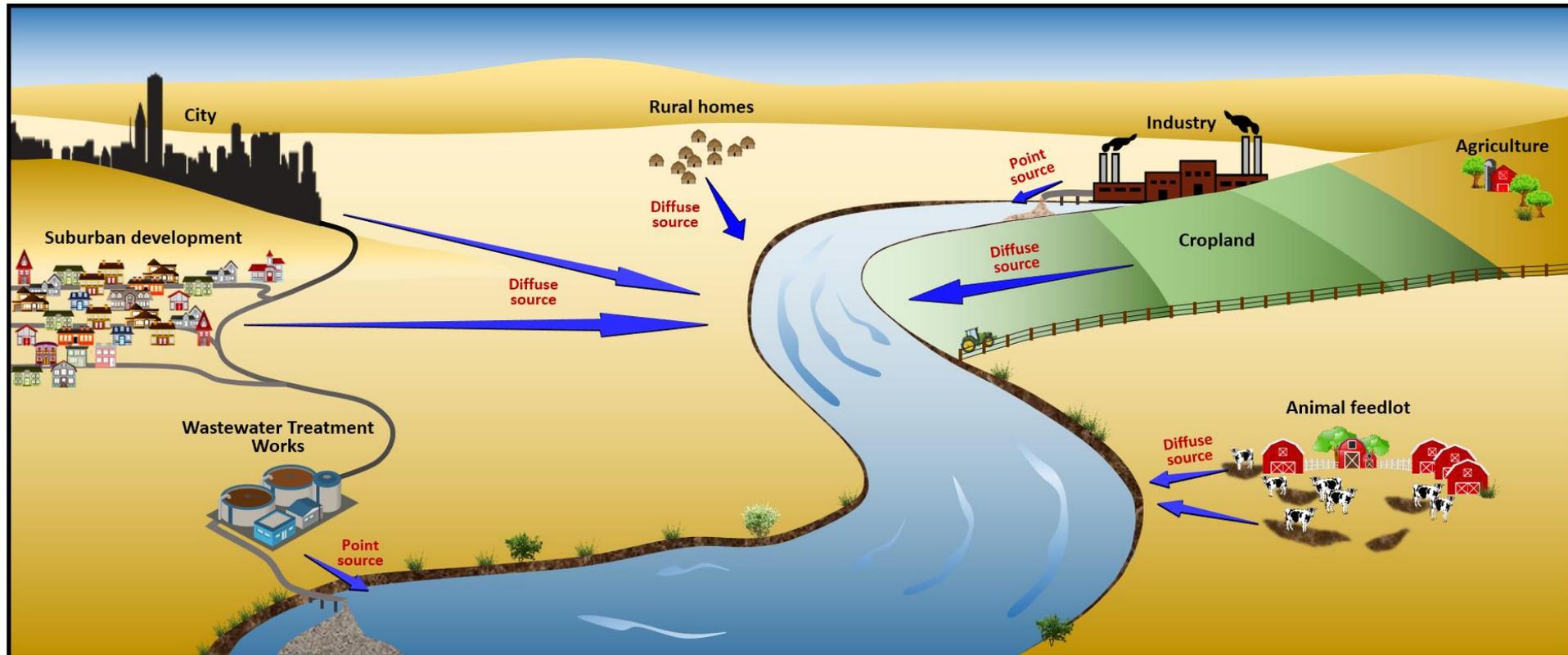


■ Oligotrophic ■ Mesotrophic ■ Eutrophic ■ Hypertrophic

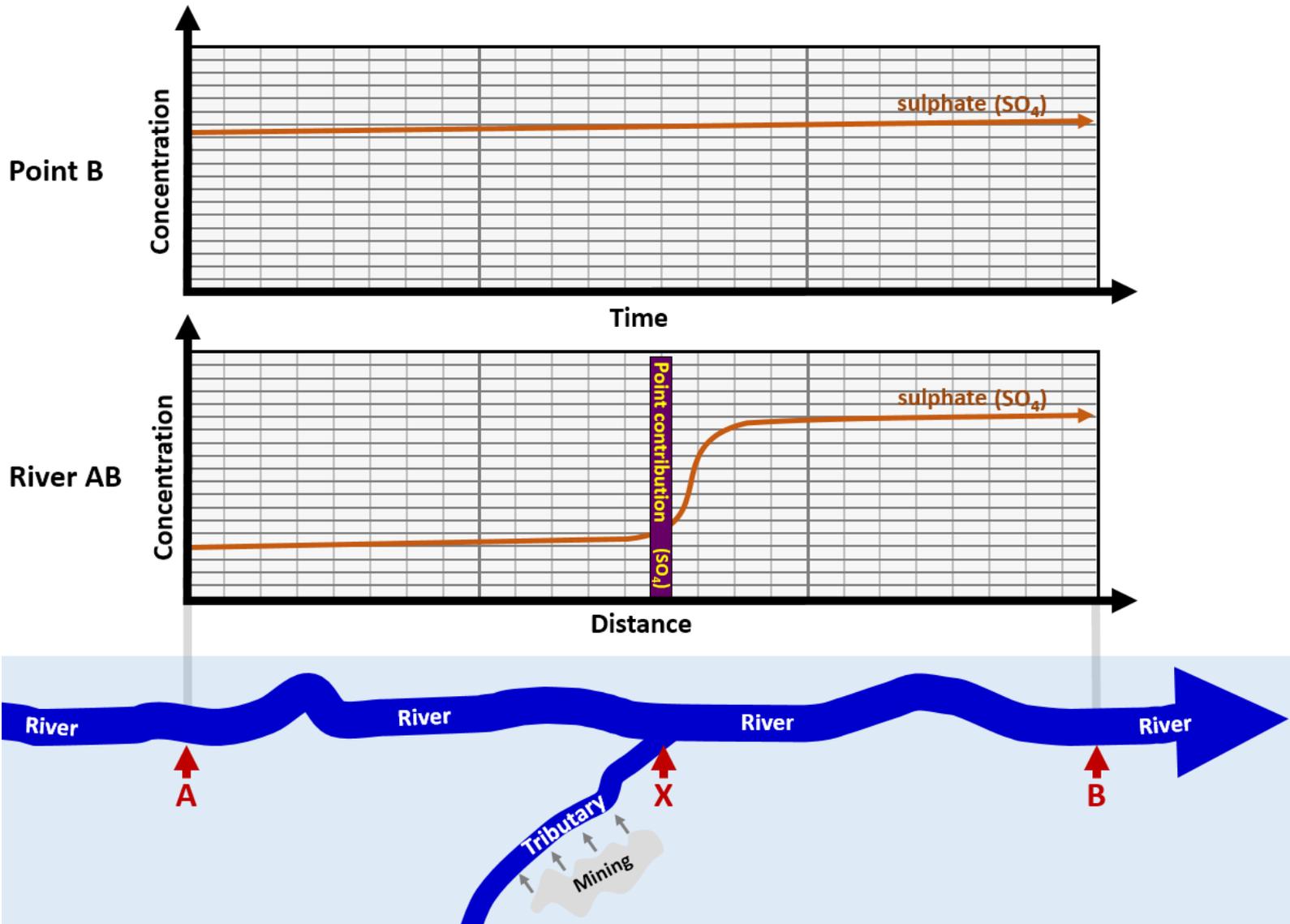
ROUTES BY WHICH NUTRIENTS ENTER WATER BODIES



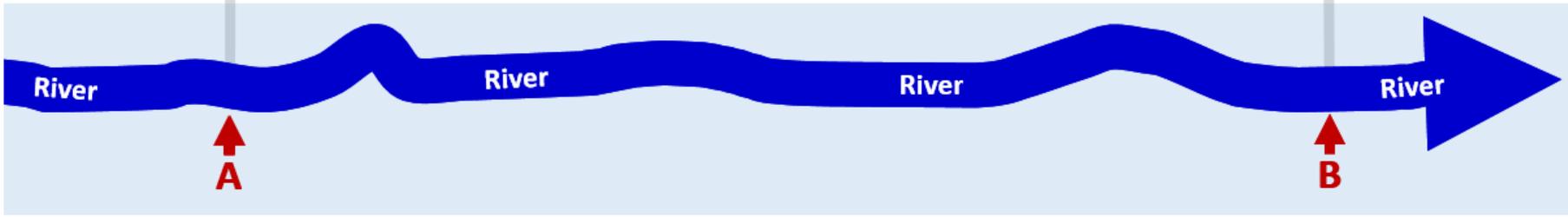
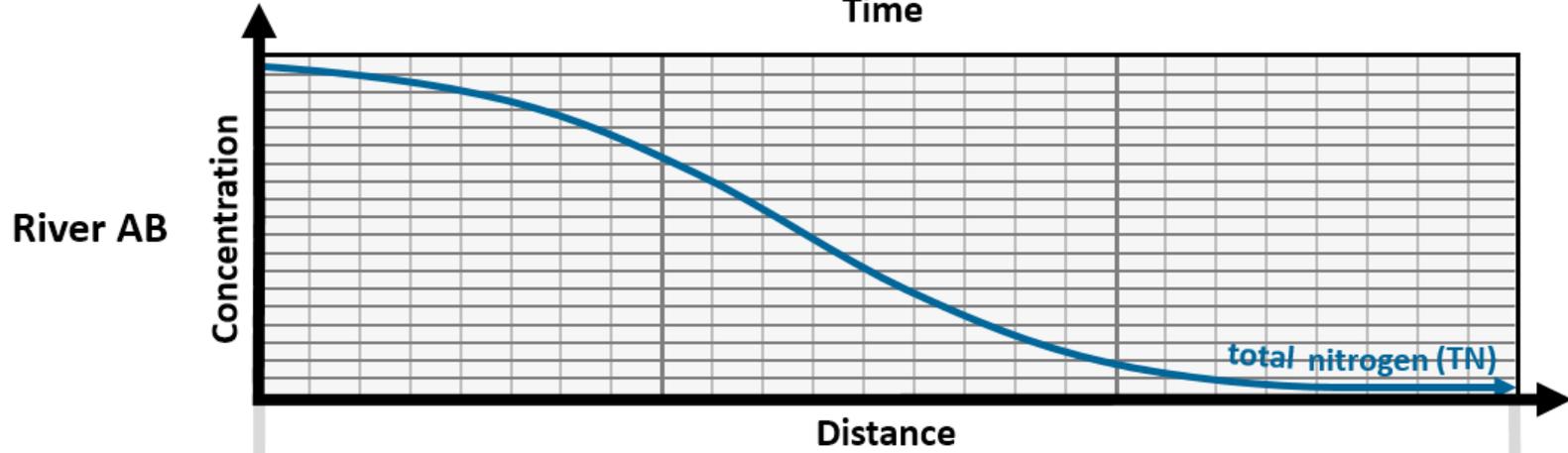
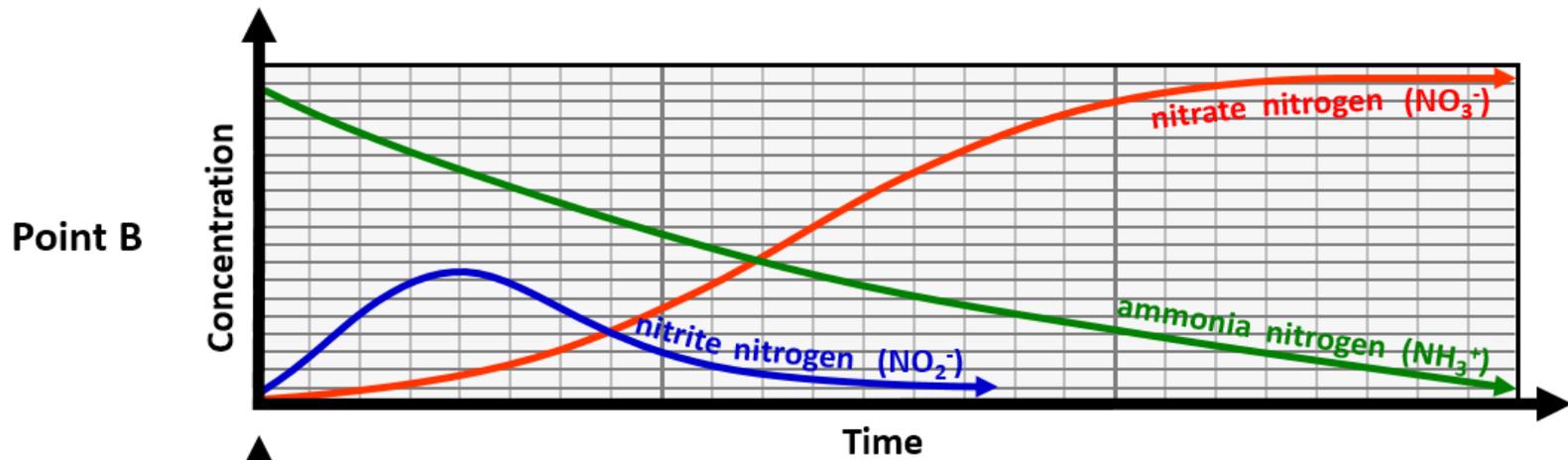
POINT AND DIFFUSE SOURCES OF NUTRIENTS IN A CATCHMENT

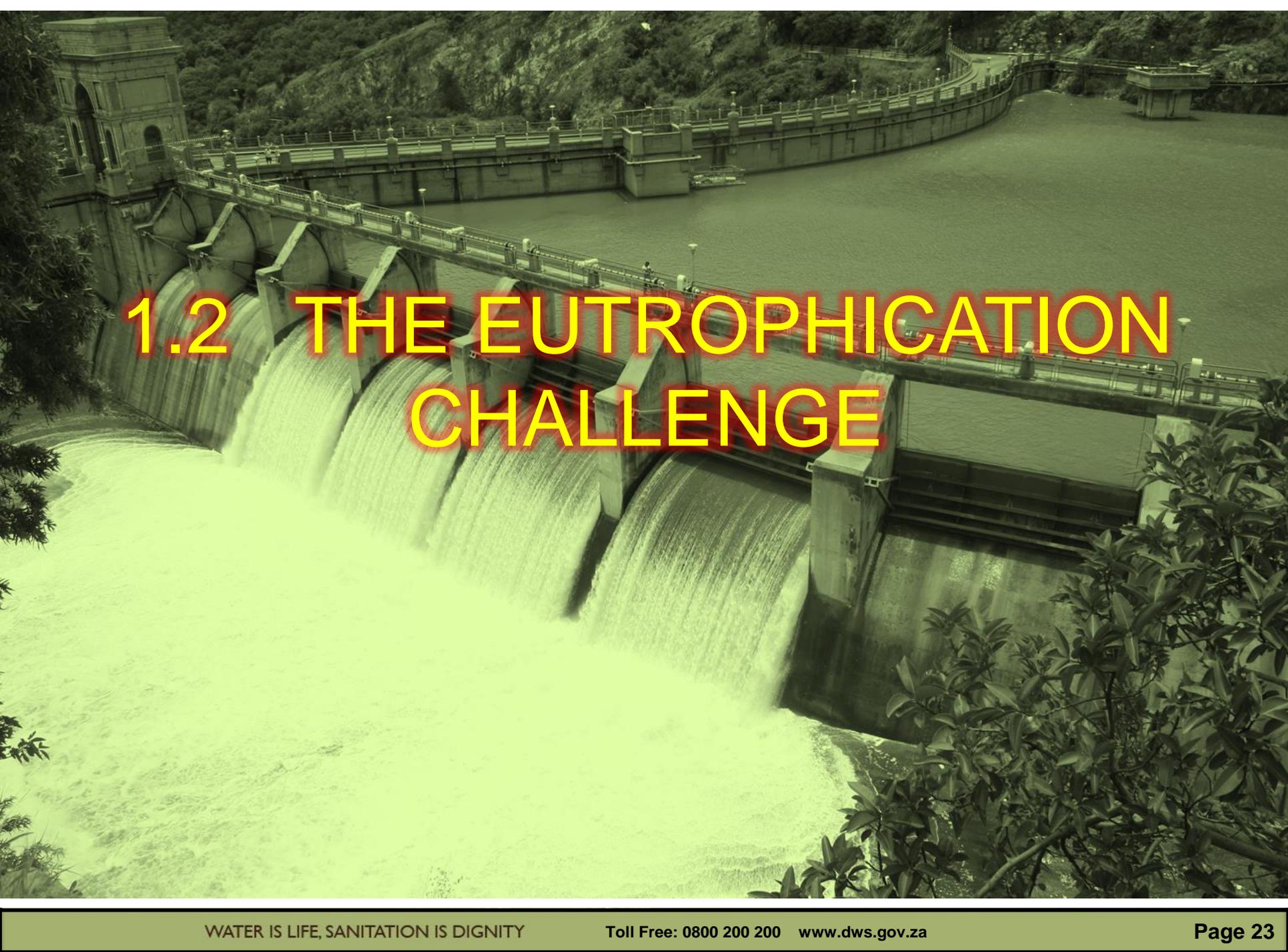


CONSERVATIVE POLLUTION



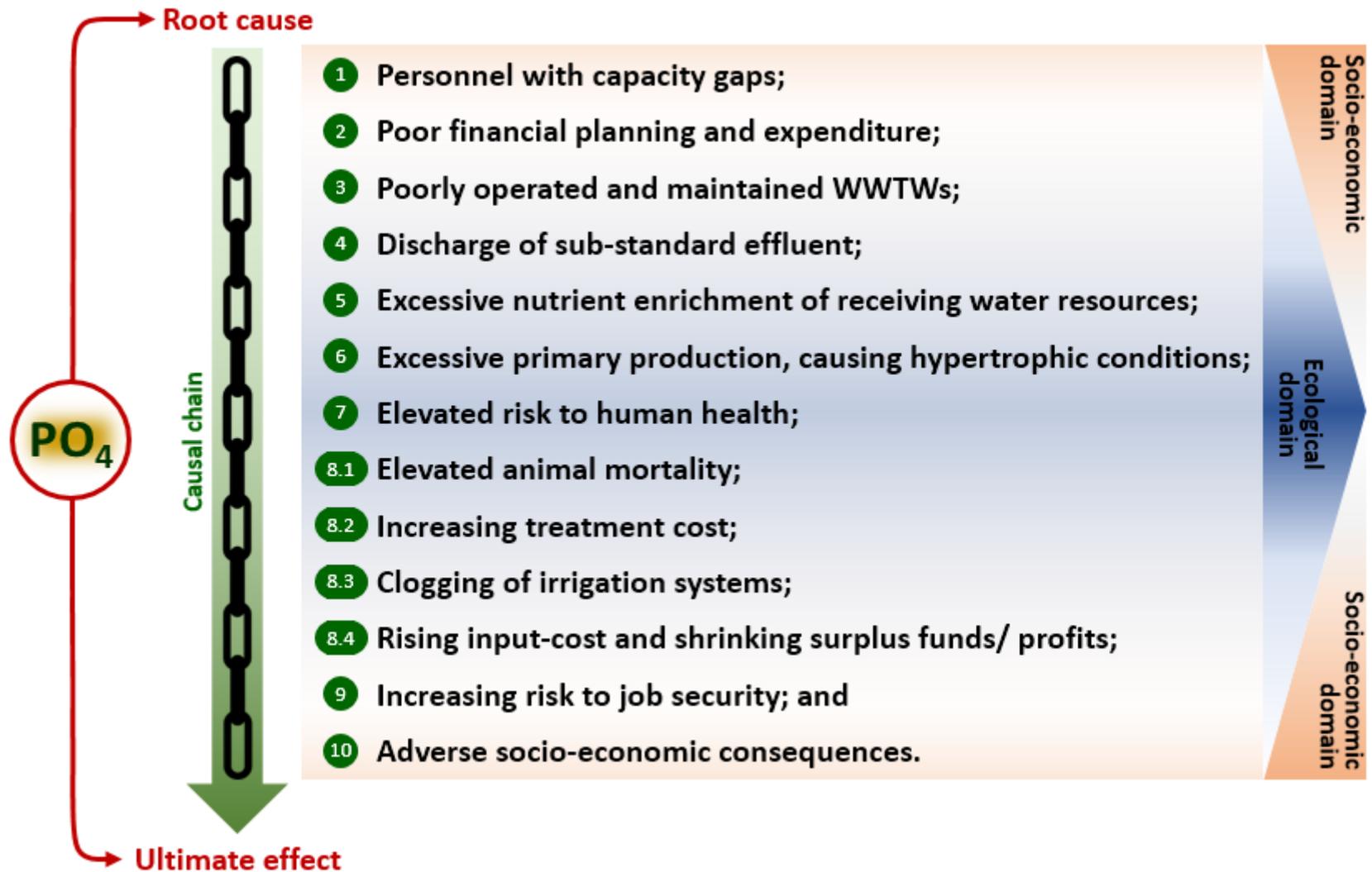
NON-CONSERVATIVE POLLUTION



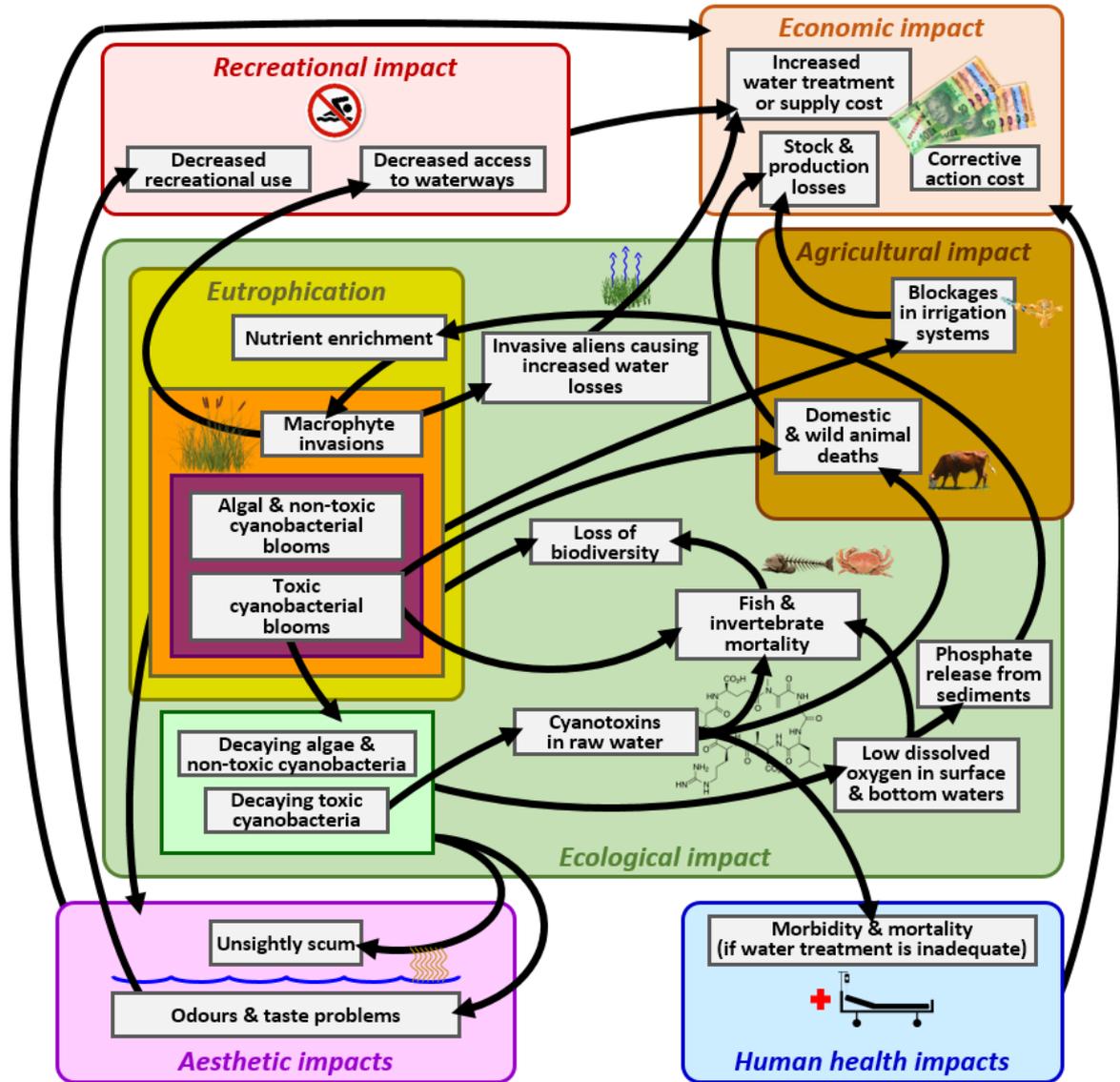


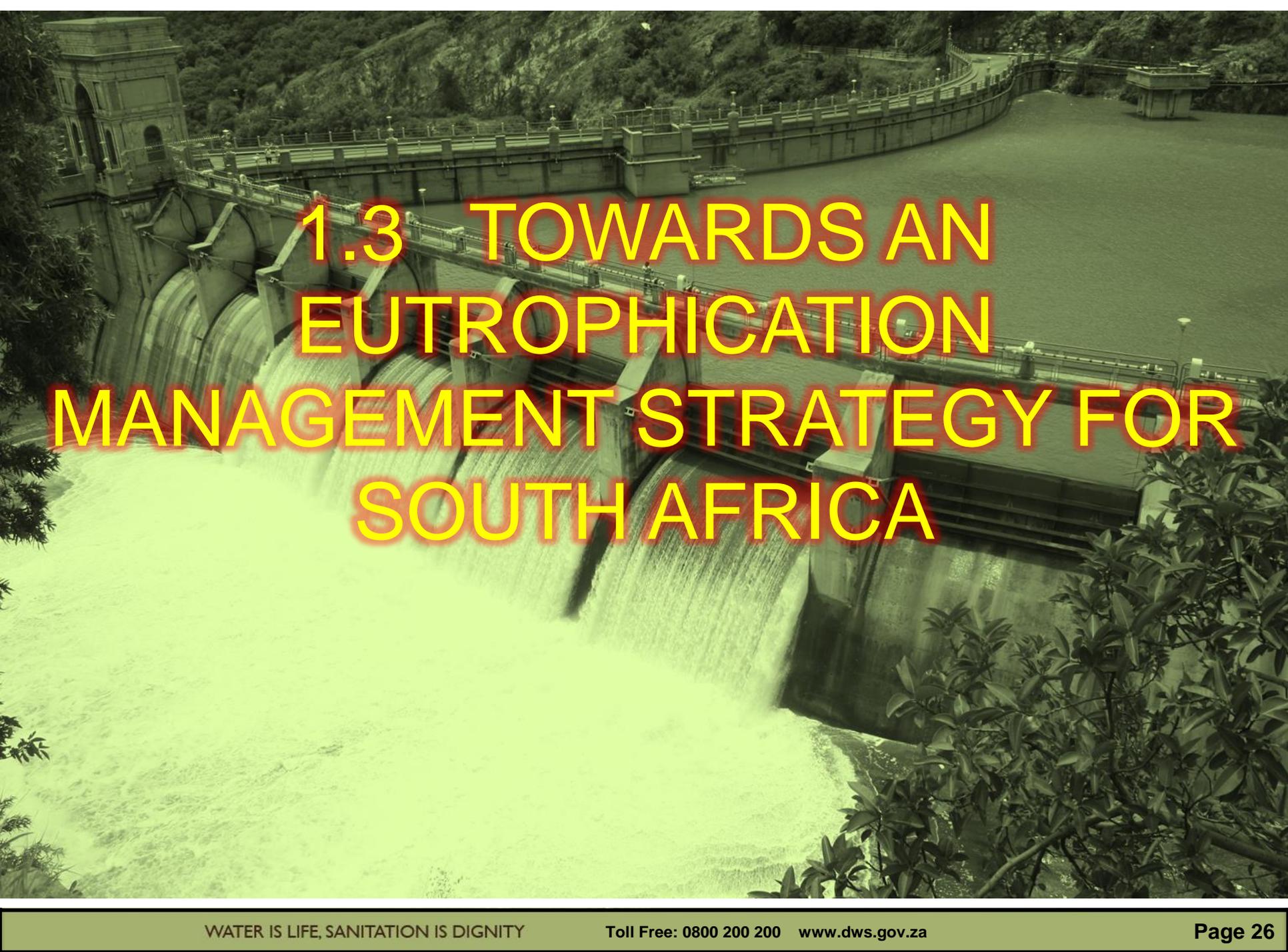
1.2 THE EUTROPHICATION CHALLENGE

POSSIBLE CAUSAL CHAIN FOR PHOSPHORUS-LOADING



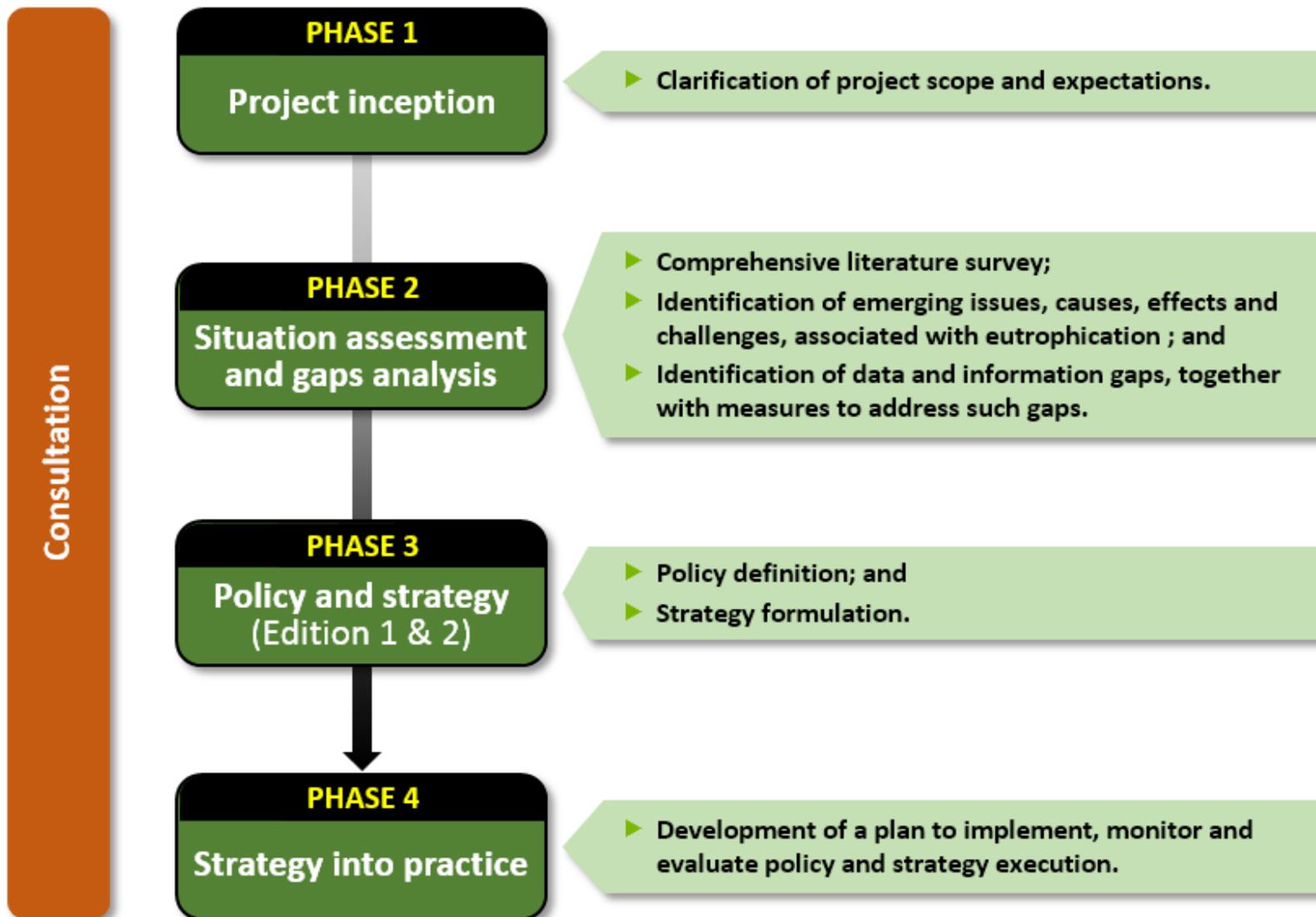
PROMINENT DETRIMENTAL IMPACTS



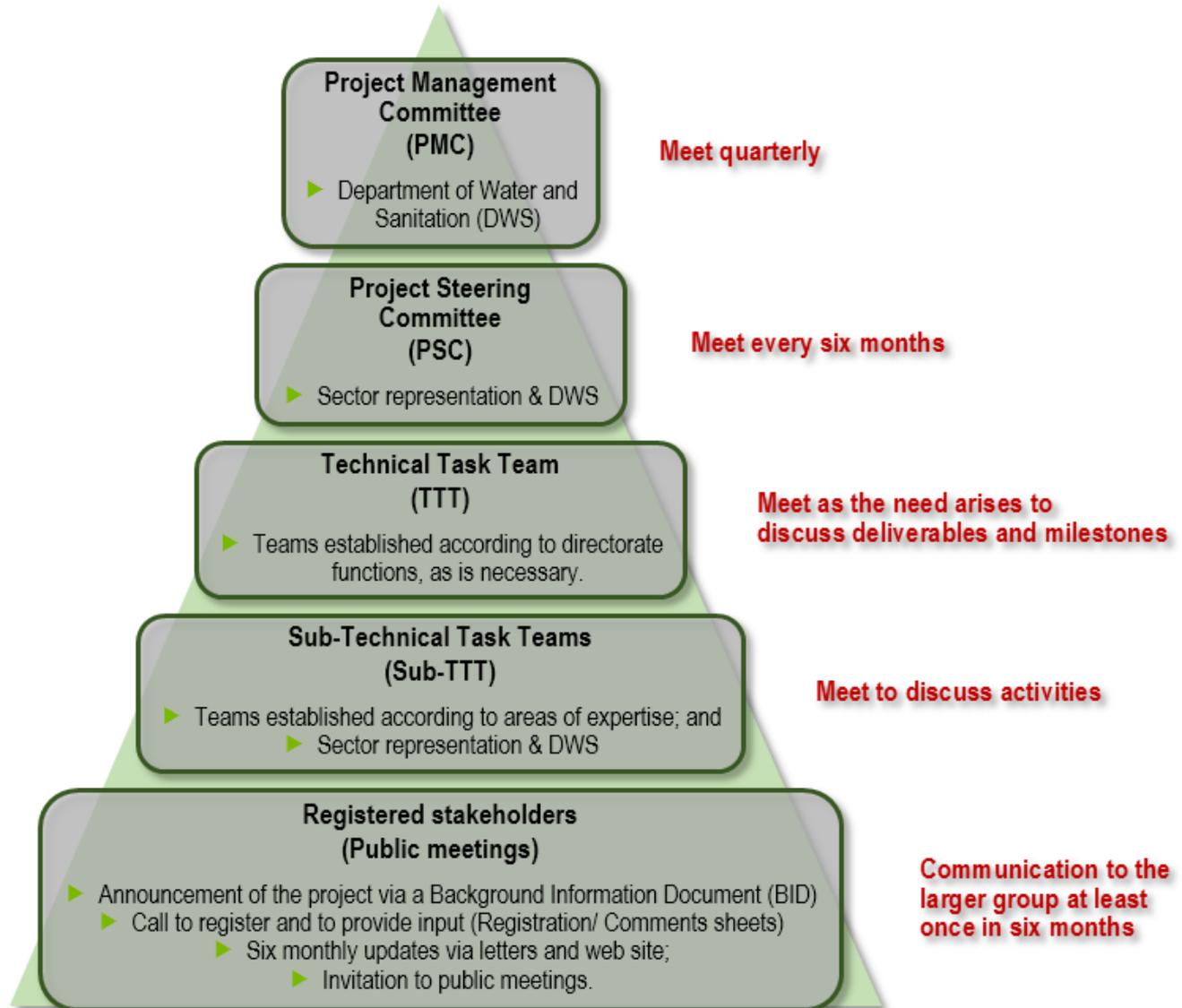


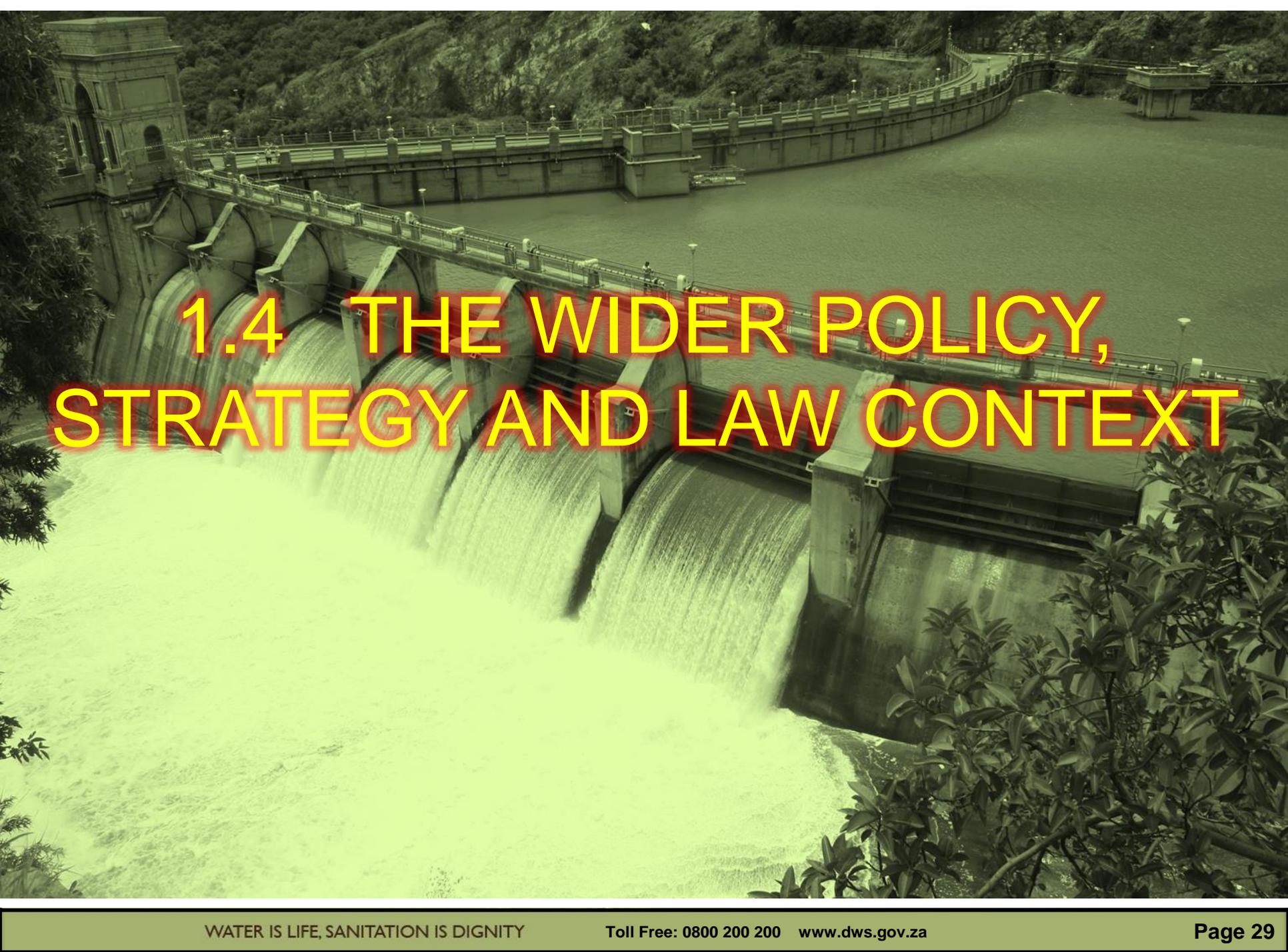
1.3 TOWARDS AN EUTROPHICATION MANAGEMENT STRATEGY FOR SOUTH AFRICA

POLICY AND STRATEGY DEVELOPMENT PROCESS



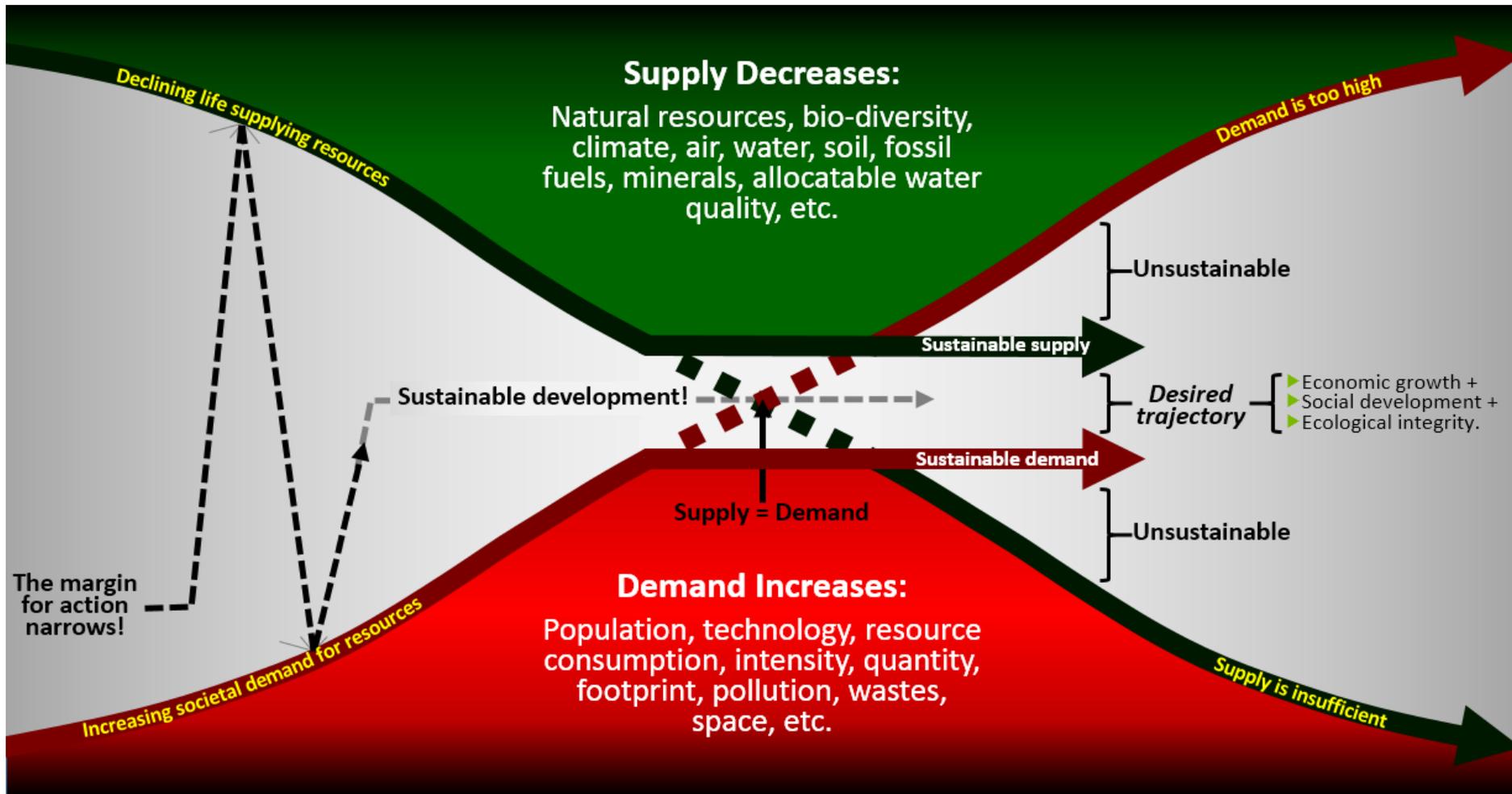
STAKEHOLDER CONSULT





1.4 THE WIDER POLICY, STRATEGY AND LAW CONTEXT

CONVERGING GLOBAL SUPPLY & DEMAND



KEY PIECES OF NATIONAL LEGISLATION

Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996): Bill of Rights: Implications for water resources

ENVIRONMENT

Section 24 addresses the “*environment*” in its broad context, considering the ecology, social and economic dimensions.

WATER RESOURCES

Section 24 paraphrased to address the “*freshwater environment*”, as a subset of the “*environment*”, considering the ecology, social and economic dimensions.

Everyone has the right-

(a) to an **environment** that is not harmful to their health or well-being; and

(b) to have the **environment** protected, for the benefit of present and future generations, through reasonable legislative and other measures that-

(i) prevent pollution and ecological degradation;

(ii) promote **conservation**; and

(iii) secure ecologically sustainable development and use of **natural resources** while promoting justifiable economic and social development.

Everyone has the right-

(a) to **water resources** that is not harmful to their health or well-being; and

(b) to have **water resources** protected, for the benefit of present and future generations, through reasonable legislative and other measures that-

(i) prevent pollution and ecological degradation;

(ii) **conserve water**; and

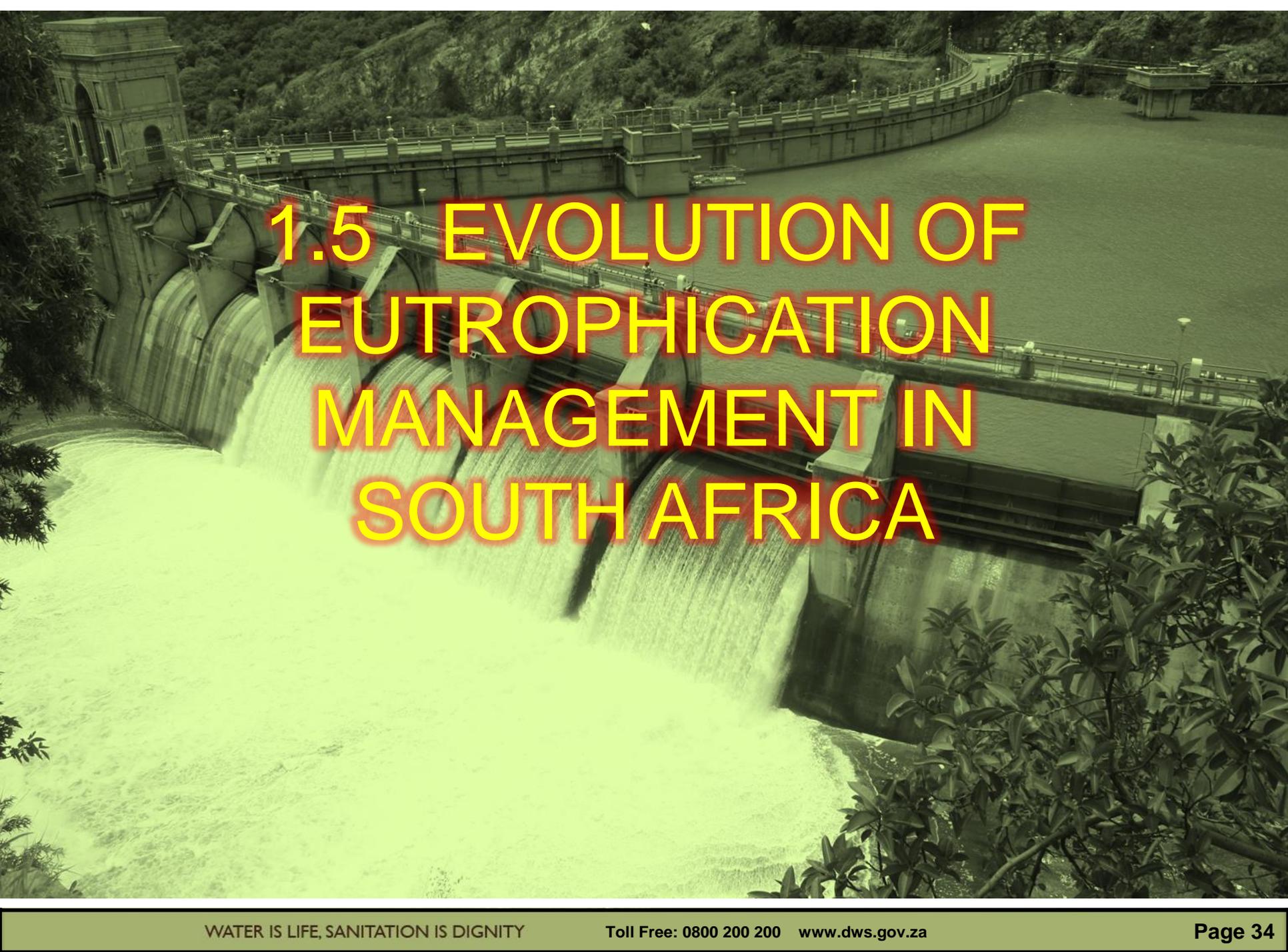
(iii) secure ecologically sustainable development and use of **water resources** while promoting justifiable economic and social development.

KEY PIECES OF LEGISLATION

- ▶ **National Environmental Management Act, 1998 (Act No. 107 of 1998);**
- ▶ **National Water Act, 1998 (Act No. 36 of 1998); and**
- ▶ **Water Services Act, 1997 (Act No.108 of 1997).**

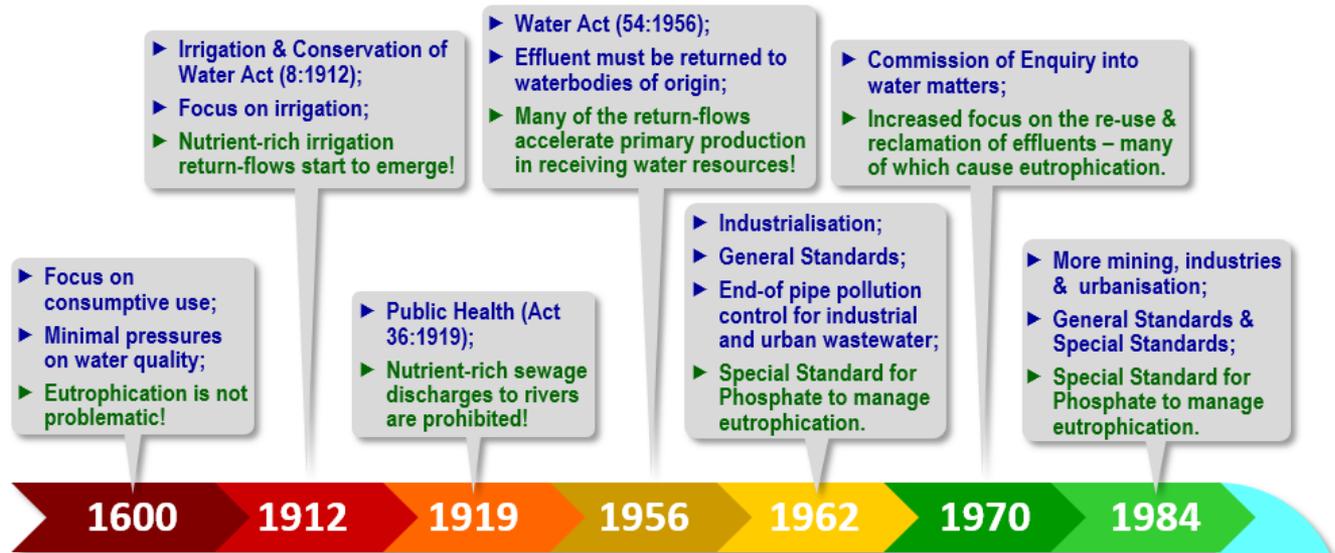
SELECTED EXECUTIVE STRATEGIES, PLANS OR FRAMEWORKS

- ▶ **National Water Resource Strategy (NWRS);**
- ▶ **National Water and Sanitation Master Plan (NW&S MP);**
- ▶ **National Development Plan (NDP, 2030); and**
- ▶ **National Water Security Framework.**

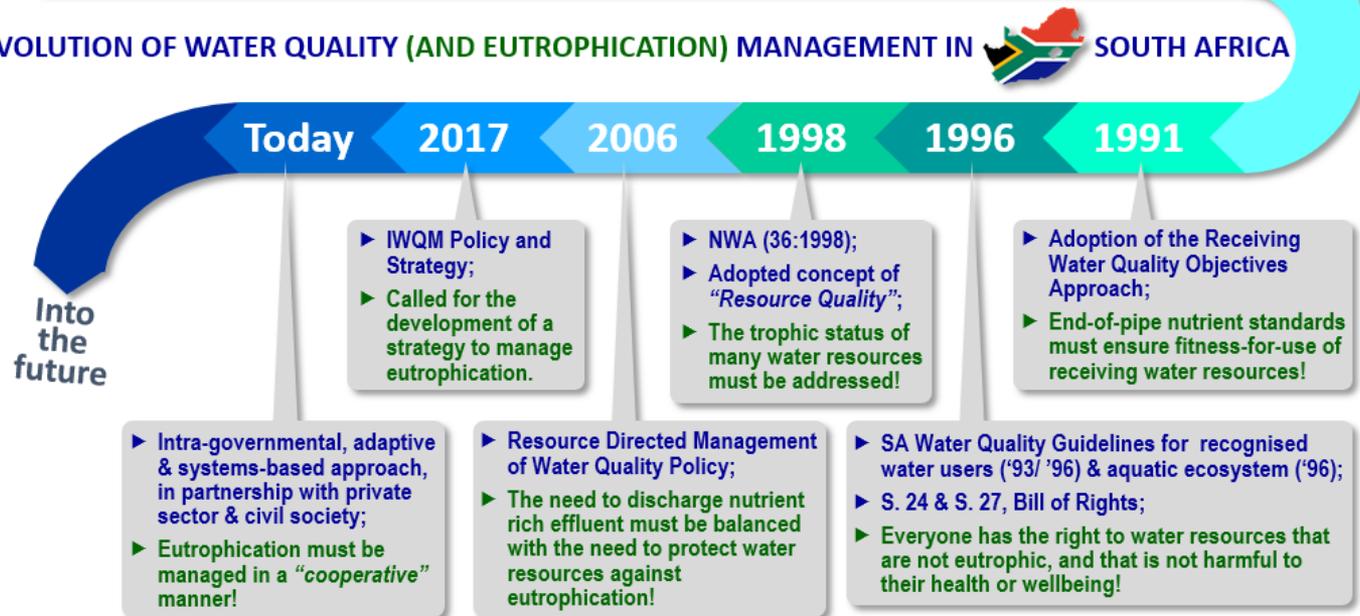


1.5 EVOLUTION OF EUTROPHICATION MANAGEMENT IN SOUTH AFRICA

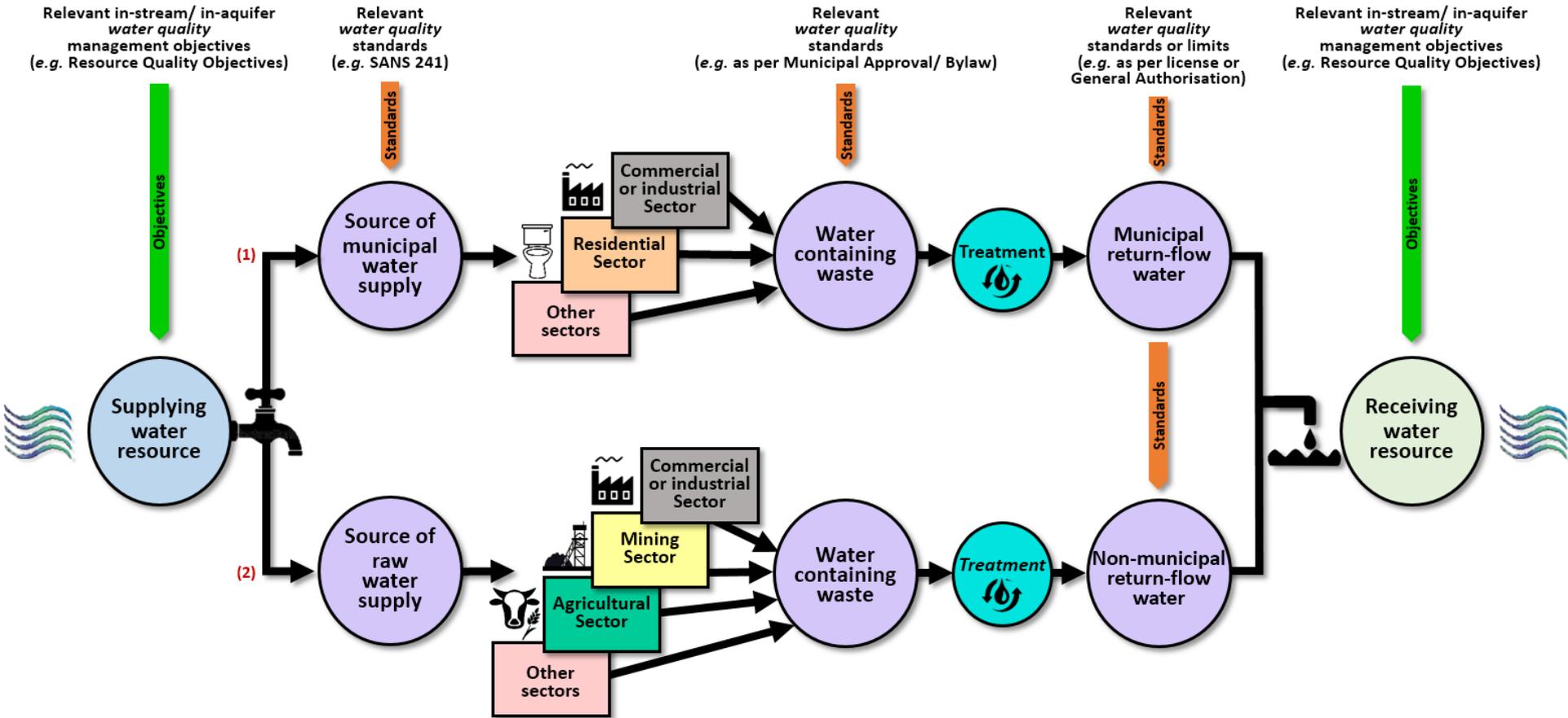
PAST, PRESENT AND FUTURE PARADIGMS



EVOLUTION OF WATER QUALITY (AND EUTROPHICATION) MANAGEMENT IN SOUTH AFRICA



"FROM RESOURCE TO SOURCE TO RESOURCE"



PART 2:

EUTROPHICATION MANAGEMENT POLICY FOR SOUTH AFRICA

POLICY OUTLINE

Vision: Government, in partnership with private sector and civil society, secures water that is fit-for-use, for all, for ever!

Mission: To adopt a government-wide, adaptive and systems-based management approach, in alliance with the private sector and civil society, that will improve resource water quality, prevent pollution and ecological degradation, support ecologically sustainable economic & social development and allow an informed use of the nation's water resources.

Goal: To manage eutrophication effectively in order to protect aquatic ecosystems and secure water resources that are fit-for-use.

CHIEF-OBJECTIVES:

- ▶ To limit anthropogenic nutrient-loading of water resources;
- ▶ To reduce excessive primary production in surface water resources;
- ▶ To protect aquatic ecosystems and their biological diversity;
- ▶ To secure water resources that are fit-for-use on a continuous basis; and
- ▶ To support ecologically sustainable development and justifiable socio-economic growth.

POLICY STATEMENTS 1 to 14

COMPLEMENTING OBJECTIVES:

- ▶ To appropriately resource eutrophication management, *inter alia*, by securing funding, providing human capital and equipping responsible parties;
- ▶ To promote research in relation to the management of eutrophication and the control of anthropogenic sources of nutrient enrichment;
- ▶ To promote internal and external management cooperation between government, private sector and civil society;
- ▶ To promote transparency through eutrophication-related communication and awareness creation; and
- ▶ To facilitate capacity building and the empowerment of role-players.

POLICY STATEMENTS 15 to 19

POLICY OBJECTIVES (1/2)

STATEMENT #	POLICY STATEMENT	STATUS
<i>Policy statements in support of the Chief Policy Objectives</i>		
POLICY STATEMENT 1	Application of management instruments for environmental compliance in eutrophication management	New
POLICY STATEMENT 2	The mitigation hierarchy for decision-making on eutrophication	Existing
POLICY STATEMENT 3	The differentiated approach for the control of excessive nutrient-loading	Existing
POLICY STATEMENT 4	The application of the precautionary principle	Existing
POLICY STATEMENT 5	The Receiving Water Quality Objectives approach applied to eutrophication management	Existing
POLICY STATEMENT 6	A life cycle view on nutrient-loading	New
POLICY STATEMENT 7	Incentive-based regulation	Existing
POLICY STATEMENT 8	Nature-based solutions	New
POLICY STATEMENT 9	The application of the Best Practicable Environmental Option	New
POLICY STATEMENT 10	Holistic eutrophication management	New
POLICY STATEMENT 11	Eutrophication management responsibility and accountability	New
POLICY STATEMENT 12	Monitoring	Existing
POLICY STATEMENT 13	Information management	Existing
POLICY STATEMENT 14	Water resource assessment and planning to inform decision-making	Existing

POLICY OBJECTIVES (2/2)

STATEMENT #	POLICY STATEMENT	STATUS
<i>Policy statements in support of the Complementing Objectives</i>		
POLICY STATEMENT 15	Resourcing of eutrophication management	New
POLICY STATEMENT 16	Promotion of eutrophication-related research	Existing
POLICY STATEMENT 17	Transparency	Existing
POLICY STATEMENT 18	Technical capacity to take eutrophication management action	Existing
POLICY STATEMENT 19	Cooperative management of eutrophication	Existing

PART 3:

EUTROPHICATION MANAGEMENT STRATEGY FOR SOUTH AFRICA

STRATEGY OUTLINE

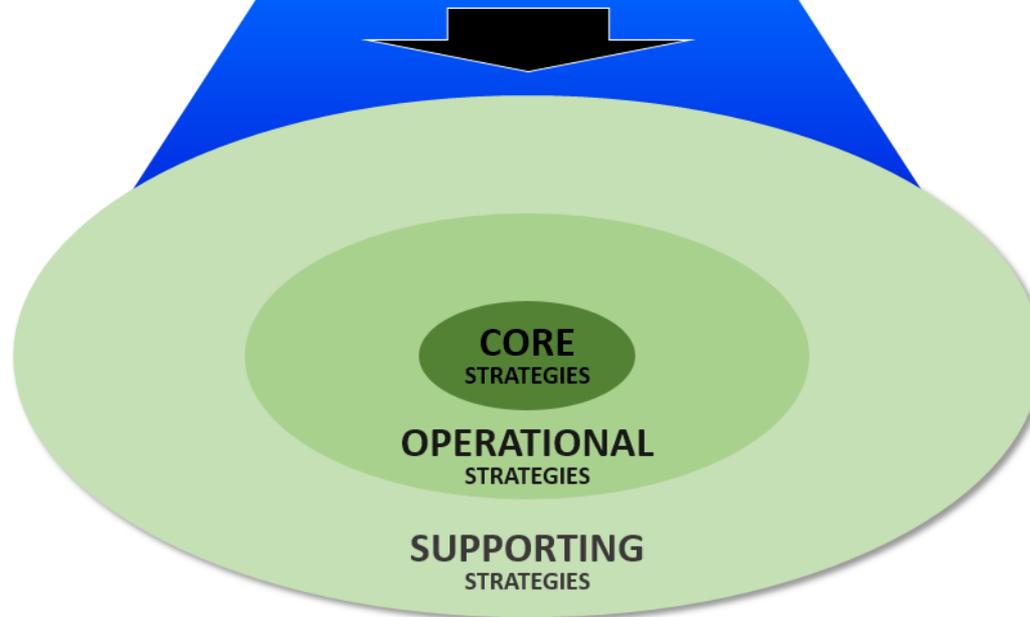
Goal: To manage eutrophication effectively in order to protect aquatic ecosystems and secure water resources that are fit-for-use.

CHIEF-OBJECTIVES:

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- ▶ To promote transparency through eutrophication-related communication and awareness creation; and
- ▶ To facilitate capacity building and the empowerment of role-players.

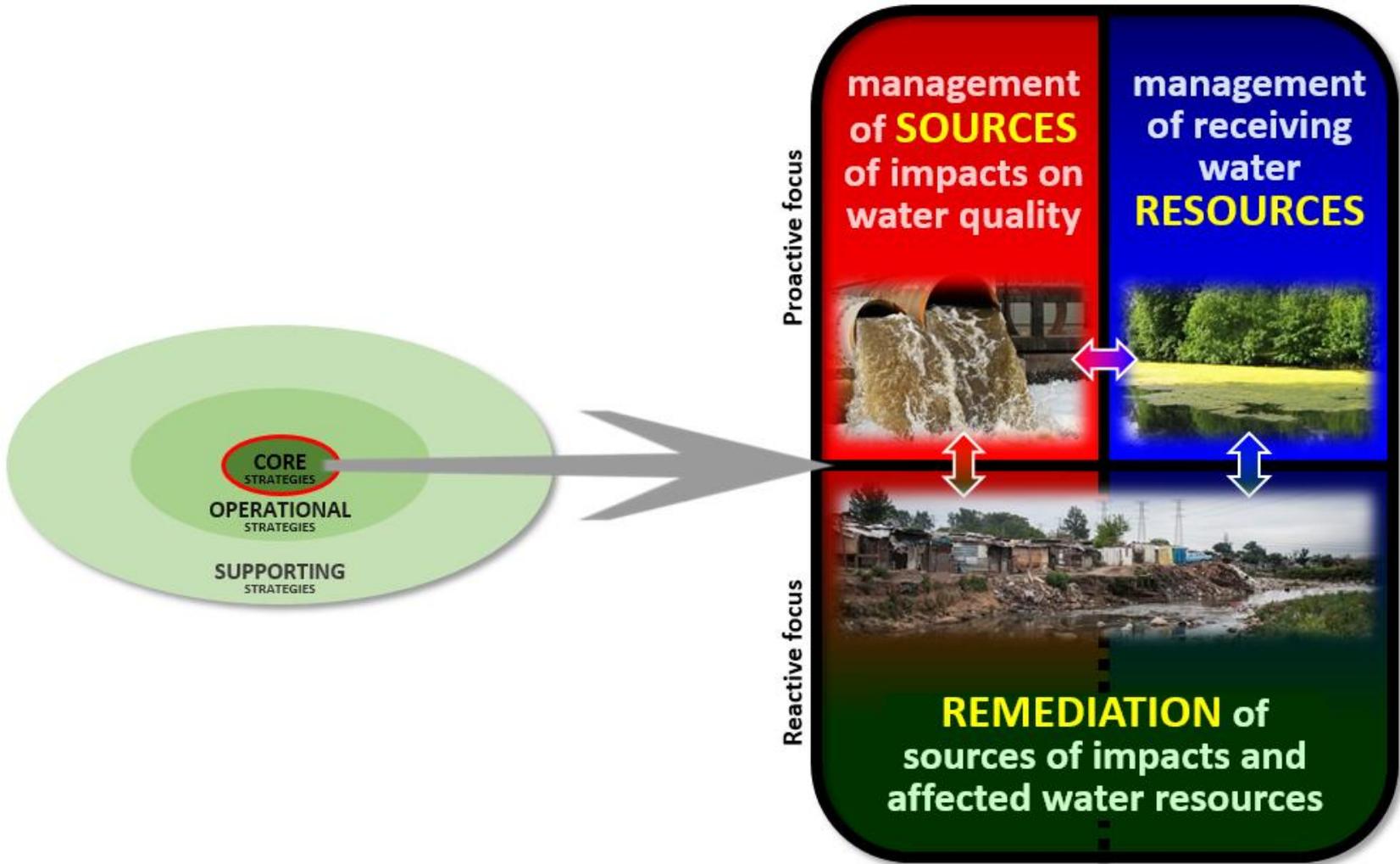


EUTROPHICATION MANAGEMENT STRATEGY FOR SOUTH AFRICA



3.1 CORE STRATEGIES

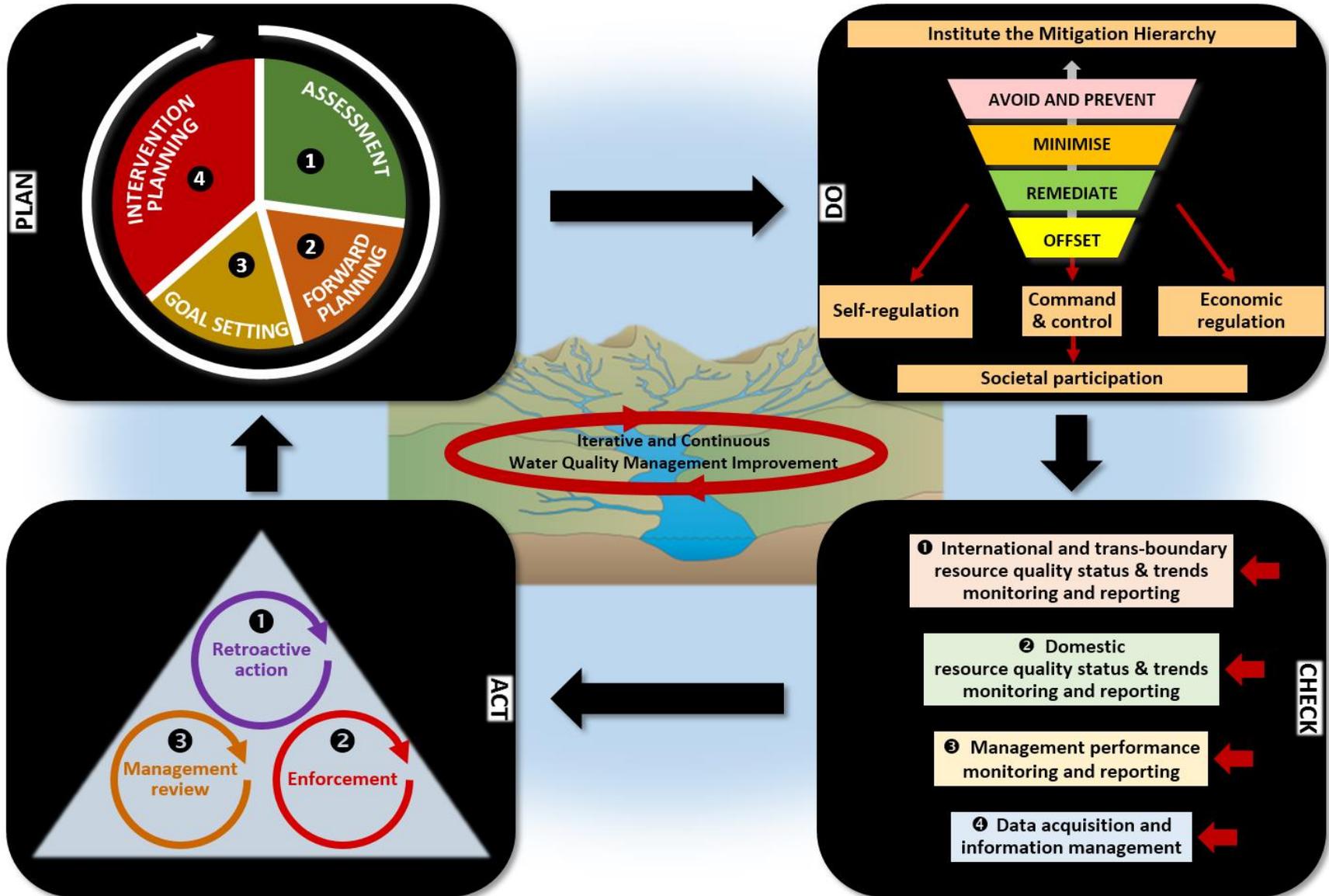
CORE STRATEGIES FOR EUTROPHICATION MANAGEMENT





3.2 OPERATIONAL STRATEGIES

OPERATIONAL STRATEGIES FOR EUTROPHICATION MANAGEMENT



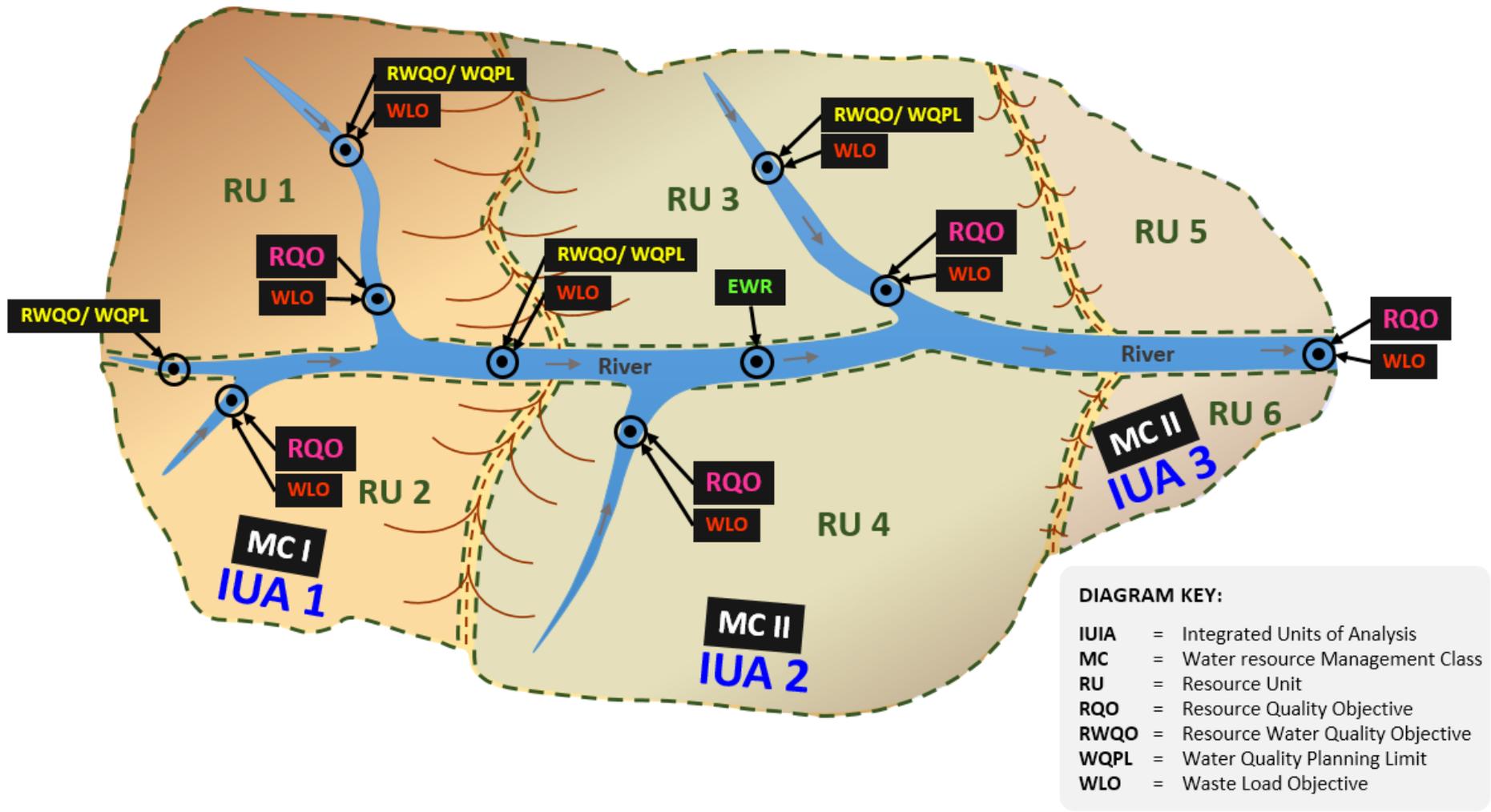
THE "PLAN" STAGE CONCEPTUALISED



OPERATIONAL STRATEGIES IN THE “PLAN” STAGE

OPERATIONAL STRATEGIES AND PURPOSE			KEY COMPONENT(S)
1.	Assessment	<i>To describe and understand the catchment, or geographical area, under investigation.</i>	<p>Stakeholders and role-player identification and consultation;</p> <p>Examination of existing and available information;</p> <p>Identification and addressing of information shortcomings;</p> <p>Consideration of important catchment and socio-economic attributes;</p> <p>Evaluation of the historic and current resource quality; and</p> <p>Examination of historic and current point and diffuse impacts.</p>
2.	Forward planning	<i>To support decision making by adding value to the assessment.</i>	<p>Configuration, calibration and use of predictive tools;</p> <p>Waste load accounting;</p> <p>Water quality forecasting, trends analysis and scenario definition;</p> <p>Visioning to propose levels for water resource protection.</p>
3.	Goal setting	<i>To define desired outcomes, based on information from the assessment and forward planning.</i>	<p>Determination of Resource Water Quality Objectives or Water Quality Planning Limits;</p> <p>Determination of Waste Load Objectives</p> <p>Determination of statutory Resource Directed Measures; and</p> <p>Determination of remediation objectives for pollution sources and water resources.</p>
4.	Intervention planning	<i>To devise detailed approaches to realise the desired outcomes.</i>	<p>Confirmation of the water quality constituents of concern and catchment pressures;</p> <p>Scenario evaluation and management intervention options analysis;</p> <p>Reconciliation and allocation of water quality;</p> <p>Identification of possible implications for water resource systems operation;</p> <p>Identification and development of linkages with land use planning and management;</p> <p>Establishment of geographical water quality management strategies and thematic plans;</p> <p>Infrastructure planning, if called for; and</p> <p>Implementation coordination and maintenance.</p>

IN-WATER RESOURCE WQ OBJECTIVES AND WLOs



THE "DO" STAGE CONCEPTUALISED

Mitigation Hierarchy for decision-making on eutrophication

Instruments for environmental compliance applied to the management of anthropogenic eutrophication

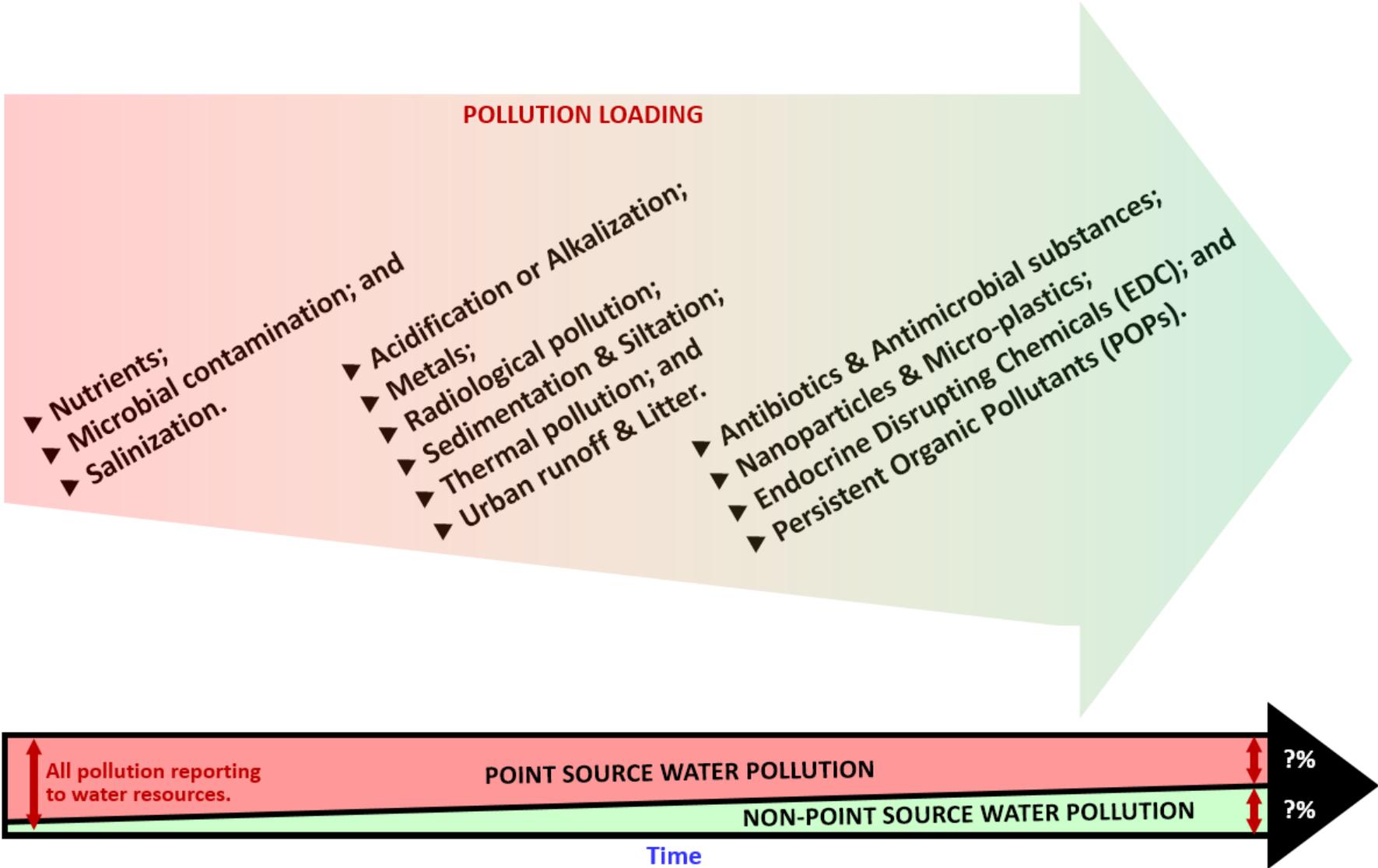
Prominent strategies to limit excessive nutrient-loading



OPERATIONAL STRATEGIES IN THE “DO” STAGE

OPERATIONAL STRATEGIES AND PURPOSE			KEY COMPONENT(S)
1.	Best management practice	<i>To apply management practices that limit excessive nutrient-loading.</i>	Best available technology; Cleaner technology and cleaner production Conversion of environmental problems into socio-economic and developmental solutions; Waste reduction, recycling and reuse; The use of buffer zones; and The use of constructed wetlands.
2.	Water use authorisation and conditional regulation	<i>To enforce conditional authorisations and other regulatory requirements that limit excessive nutrient-loading.</i>	National Water Pollutant Register Waste Discharge Standards (WDSs); Water use; Registration of water use; Lawful water use; Schedule 1 water use; General Authorisations; Existing Lawful water Use (ELU); Water use licensing; Alternative authorisations; Diffuse pollution sources; and Differentiated water use management based on risk.
3.	Incentive-based regulation	<i>To incentivise responsible behaviour that limits excessive nutrient-loading.</i>	Waste Discharge Charge System (WDCS); Certification Schemes; Water Polluter Register; and Eco-labelling.

CHANGING CHARACTER OF WATER POLLUTION



THE “CHECK” STAGE CONCEPTUALISED

① International and trans-boundary resource quality status & trends monitoring and reporting

Agenda 2030

Other programmes

② Domestic resource quality status & trends monitoring and reporting

Compliance monitoring programmes

The National Eutrophication Monitoring Programme

Regional eutrophication monitoring programmes

Citizen science water resource monitoring

③ Management performance monitoring and reporting

Employee performance evaluation

Evaluation of the effectiveness of the regulatory environment

④ Data acquisition and information management

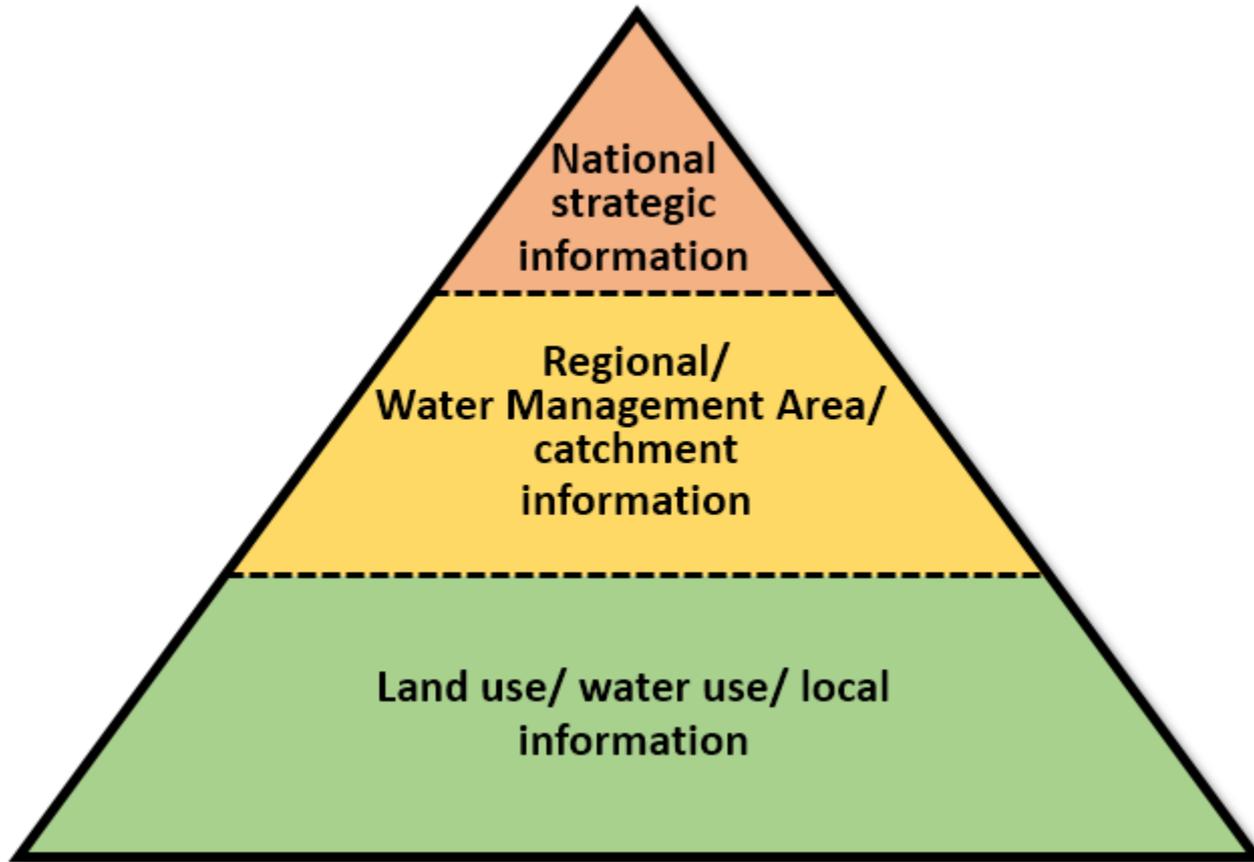
Technological advancement

Information management systems

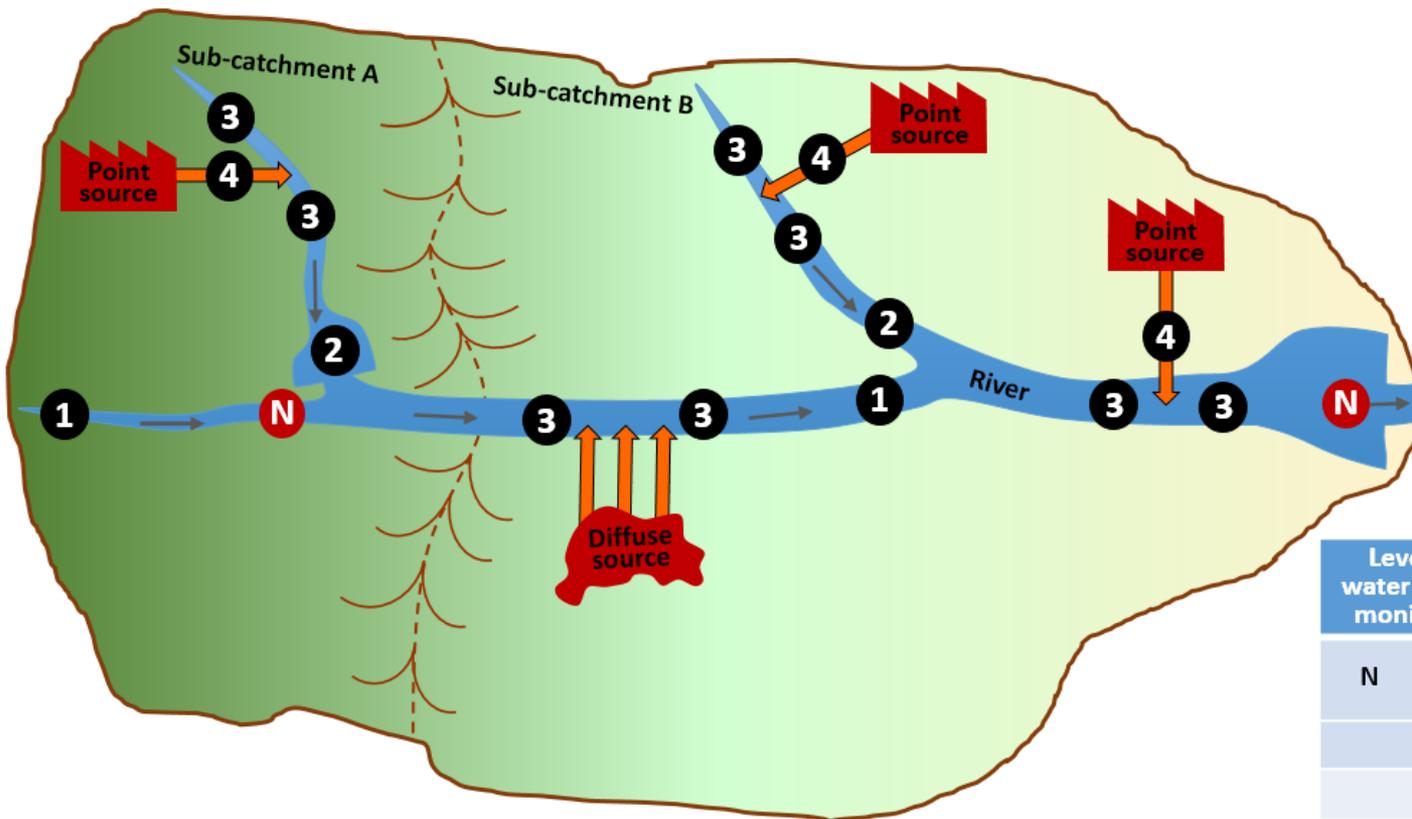
OPERATIONAL STRATEGIES IN THE “CHECK” STAGE

OPERATIONAL STRATEGIES AND PURPOSE			KEY COMPONENT(S)
1.	International and trans-boundary resource quality status and trends monitoring and reporting	<i>To support transboundary and international eutrophication management related monitoring programmes.</i>	Agenda 2030 and potential similar future programmes; and Other international and trans-boundary eutrophication-related monitoring programmes.
2.	Domestic resource quality status and trends monitoring and reporting	<i>To monitor land and water use compliance to eutrophication management related regulatory requirements, and to track the national and regional trophic statuses of water resources.</i>	Compliance monitoring programmes; The National Eutrophication Monitoring Programme; Regional eutrophication monitoring programmes; and Citizen science water resource monitoring.
3.	Management performance monitoring and reporting	<i>To track the implementation and effectiveness of eutrophication management measures.</i>	Employee performance evaluation; and Evaluation of the effectiveness of the regulatory environment.
4.	Data acquisition and information management	<i>To ensure access to eutrophication-related data and information.</i>	Technological advancement; and Information management systems.

HIERARCHY OF INFORMATION REQUIREMENTS



COMPLIANCE, AND NATIONAL AND REGIONAL MONITORING



Levels of water quality monitoring		Description
N	1	Strategic status and trends monitoring
	2	
3	Impact & Water Use Authorisation compliance monitoring	
4		

THE “ACT” STAGE CONCEPTUALISED

- ▶ The use of Trophic Status Indices, as prompt to act;
- ▶ Duty of care and the remediation of legacy pollution sources;
 - ▶ Duty of care and the control of incidents or accidents;
- ▶ The remediation of adversely affected water resources; and
- ▶ The eradication of alien vegetation as a means to mitigate against eutrophication.

1
Retroactive
action

3
Management
review

2
Enforcement

- ▶ Policy and strategy revision, where necessary; and
- ▶ Continuous management improvement – closing the loop.

- ▶ Administrative penalties;
- ▶ Prosecution; and
- ▶ Conflict resolution.

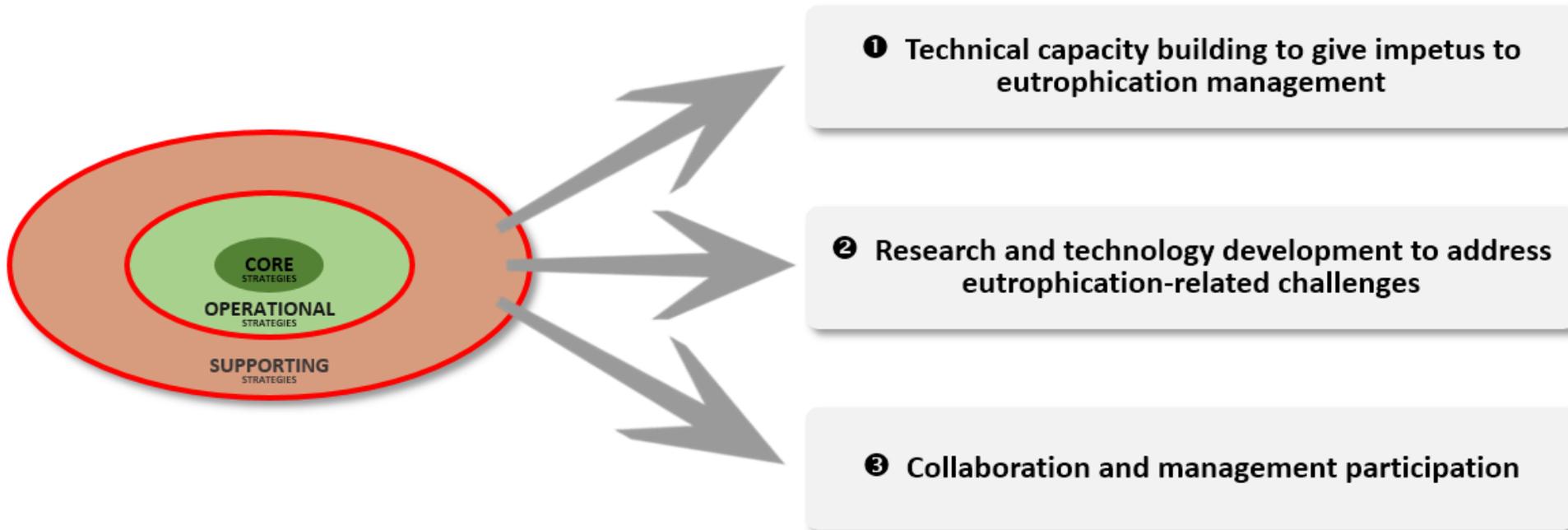
OPERATIONAL STRATEGIES IN THE “ACT” STAGE

OPERATIONAL STRATEGIES AND PURPOSE		KEY COMPONENT(S)
1. Retroactive action	To institute retroactive action to address legacy cases of excessive nutrient-loading or residual effects of anthropogenic eutrophication.	The use of Trophic Status Indices, as prompt to act;
		Duty of care and the remediation of legacy pollution sources;
		Duty of care and the control of incidents or accidents;
		The remediation of adversely affected water resources; and
		The eradication of alien vegetation as a means to mitigate against eutrophication.
2. Enforcement	To impose administrative and regulatory sanction that is fair and just.	Administrative penalties;
		Prosecution; and
		Conflict resolution.
3. Management review	To effect policy and strategy review, where necessary, and to facilitate continuous management improvement.	Policy and strategy revision, where necessary; and
		Continuous management improvement – closing the loop!



3.3 SUPPORTING STRATEGIES

SUPPORTING STRATEGIES FOR EUTROPHICATION MANAGEMENT



Outstanding Work

- ▶ **1x Supporting strategy;**
- ▶ **Governance (check & finalise);**
- ▶ **Way forward (Part 4);**
- ▶ **Graph (Samkele);**
- ▶ **Executive Summary;**
- ▶ **Conclusions in Parts 1, 2, 3 & 4.**

Project Management Team

Ms Tovhowani Nyamande

Director: Sources Directed Studies

Project Manager

Tel: 012 336 7521

Email: NyamandeT@dwa.gov.za

Ms Mmaphefo Thwala

Scientific Manager: Sources Directed Studies

Assistant Project Manager

Tel: 012 336 7928

Email: ThwalaM@dws.gov.za

Mr Samkele Mnyango

Production Scientist: Sources Directed Studies

Project Co-ordinator

Tel: 012 336 6900

Email: MnyangoS@dws.gov.za

<https://www.dws.gov.za/RDM/SDCCO.aspx>

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THANK YOU!